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| 3GPP TR 38.718-03-01 V0.10.0 (2024-03) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Network;  Rel-18 NR Inter-band Carrier Aggregation/Dual Connectivity for3 bands DL with x bands UL (x=1,2)  (Release 18) | |
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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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Contents

Foreword 18

1 Scope 20

2 References 20

3 Definitions of terms, symbols and abbreviations 20

3.1 Terms 20

3.2 Symbols 20

3.3 Abbreviations 20

4 Background 21

4.1 Introduction 21

4.2 TR Maintenance 21

5 Both bands within FR1 Carrier Aggregation: Specific Band Combination Part 21

5.x CA\_nX-nY-nZ 21

5.x.1 Common for 1 band UL and 2 bands UL CA 21

5.x.1.1 Operating bands for CA 21

5.x.1.2 Channel bandwidths per operating band for CA 22

5.x.1.3 ∆TIB,c and ∆RIB,c values 22

5.x.2 Specific for 2 bands UL CA 22

5.x.2.1 UE co-existence studies 22

5.x.2.2 REFSENS requirements 23

5.1 CA\_n1-n41-n79 23

5.1.1 Common for 1 band UL and 2 bands UL CA 23

5.1.1.1 Operating bands for CA 23

5.1.1.2 Channel bandwidths per operating band for CA 23

5.1.1.3 ∆TIB,c and ∆RIB,c values 24

5.1.2 Specific for 2 bands UL CA 24

5.1.2.1 UE co-existence studies 24

5.1.2.2 REFSENS requirements 24

5.2 CA\_n41-n77-n79 25

5.2.1 Common for 1 band UL and 2 bands UL CA 25

5.2.1.1 Operating bands for CA 25

5.2.1.2 Channel bandwidths per operating band for CA 25

5.2.1.3 ∆TIB,c and ∆RIB,c values 26

5.2.2 Specific for 2 bands UL CA 26

5.2.2.1 UE co-existence studies 26

5.2.2.2 REFSENS requirements 26

5.3 CA\_n3-n28-n40 26

5.3.1 Common for 1 band UL and 2 bands UL CA 26

5.3.1.1 Operating bands for CA 26

5.3.1.2 Channel bandwidths per operating band for CA 27

5.3.1.3 ∆TIB,c and ∆RIB,c values 27

5.3.2 Specific for 2 bands UL CA 27

5.3.2.1 UE co-existence studies 27

5.3.2.2 REFSENS requirements 27

5.4 CA\_n3-n8-n41 27

5.4.1 Common for 1 band UL and 2 bands UL CA 27

5.4.1.1 Operating bands for CA 27

5.4.1.2 Channel bandwidths per operating band for CA 28

5.4.1.3 ∆TIB,c and ∆RIB,c values 28

5.4.2 Specific for 2 bands UL CA 28

5.4.2.1 UE co-existence studies 28

5.4.2.2 REFSENS requirements 28

5.5 CA\_n1-n3-n26 29

5.5.1 Common for 1 band UL and 2 bands UL CA 29

5.5.1.1 Operating bands for CA 29

5.5.1.2 Channel bandwidths per operating band for CA 29

5.5.1.3 ∆TIB,c and ∆RIB,c values 29

5.5.2 Specific for 2 bands UL CA 29

5.5.2.1 UE co-existence studies 29

5.5.2.2 REFSENS requirements 29

5.6 CA\_n1-n26-n78 30

5.6.1 Common for 1 band UL and 2 bands UL CA 30

5.6.1.1 Operating bands for CA 30

5.6.1.2 Channel bandwidths per operating band for CA 30

5.6.1.3 ∆TIB,c and ∆RIB,c values 30

5.6.2 Specific for 2 bands UL CA 30

5.6.2.1 UE co-existence studies 30

5.6.2.2 REFSENS requirements 30

5.7 CA\_n3-n26-n78 31

5.7.1 Common for 1 band UL and 2 bands UL CA 31

5.7.1.1 Operating bands for CA 31

5.7.1.2 Channel bandwidths per operating band for CA 31

5.7.1.3 ∆TIB,c and ∆RIB,c values 31

5.7.2 Specific for 2 bands UL CA 32

5.7.2.1 UE co-existence studies 32

5.7.2.2 REFSENS requirements 32

5.8 CA\_n1-n7-n26 32

5.8.1 Common for 1 band UL and 2 bands UL CA 32

5.8.1.1 Operating bands for CA 32

5.8.1.2 Channel bandwidths per operating band for CA 33

5.8.1.3 ∆TIB,c and ∆RIB,c values 33

5.8.2 Specific for 2 bands UL CA 33

5.8.2.1 UE co-existence studies 33

5.8.2.2 REFSENS requirements 33

5.9 CA\_n3-n7-n26 34

5.9.1 Common for 1 band UL and 2 bands UL CA 34

5.9.1.1 Operating bands for CA 34

5.9.1.2 Channel bandwidths per operating band for CA 34

5.9.1.3 ∆TIB,c and ∆RIB,c values 34

5.9.2 Specific for 2 bands UL CA 35

5.9.2.1 UE co-existence studies 35

5.9.2.2 REFSENS requirements 35

5.10 CA\_n7-n26-n78 35

5.10.1 Common for 1 band UL and 2 bands UL CA 35

5.10.1.1 Operating bands for CA 35

5.10.1.2 Channel bandwidths per operating band for CA 36

5.10.1.3 ∆TIB,c and ∆RIB,c values 36

5.10.2 Specific for 2 bands UL CA 36

5.10.2.1 UE co-existence studies 36

5.10.2.2 REFSENS requirements 36

5.11 CA\_n3-n41-n79 37

5.11.1 Common for 1 band UL and 2 bands UL CA 37

5.11.1.1 Operating bands for CA 37

5.11.1.2 Channel bandwidths per operating band for CA 37

5.11.1.3 ∆TIB,c and ∆RIB,c values 38

5.11.2 Specific for 2 bands UL CA 38

5.11.2.1 UE co-existence studies 38

5.11.2.2 REFSENS requirements 38

5.12 CA\_n29-n70-n71 38

5.12.1 Common for 1 band UL and 2 bands UL CA 38

5.12.1.1 Operating bands for CA 38

5.12.1.2 Channel bandwidths per operating band for CA 39

5.12.1.3 ∆TIB,c and ∆RIB,c values 39

5.12.2 Specific for 2 bands UL CA 39

5.12.2.1 UE co-existence studies 39

5.12.2.2 REFSENS requirements 39

5.13 CA\_n48-n71-n77 40

5.13.1 Common for 1 band UL and 2 bands UL CA 40

5.13.1.1 Operating bands for CA 40

5.13.1.2 Channel bandwidths per operating band for CA 40

5.13.1.3 ∆TIB,c and ∆RIB,c values 40

5.13.2 Specific for 2 bands UL CA 40

5.13.2.1 UE co-existence studies 40

5.13.2.2 REFSENS requirements 42

5.14 CA\_n1-n3-n38 42

5.14.1 Common for 1 band UL and 2 bands UL CA 42

5.14.1.1 Operating bands for CA 42

5.14.1.2 Channel bandwidths per operating band for CA 43

5.14.1.3 ∆TIB,c and ∆RIB,c values 43

5.15 CA\_n1-n7-n38 43

5.15.1 Common for 1 band UL and 2 bands UL CA 43

5.15.1.1 Operating bands for CA 43

5.15.1.2 Channel bandwidths per operating band for CA 44

5.15.1.3 ∆TIB,c and ∆RIB,c values 44

5.16 CA\_n3-n7-n38 44

5.16.1 Common for 1 band UL and 2 bands UL CA 44

5.16.1.1 Operating bands for CA 44

5.16.1.2 Channel bandwidths per operating band for CA 45

5.16.1.3 ∆TIB,c and ∆RIB,c values 45

5.17 CA\_n3-n78-n79 46

5.17.1 Common for 1 band UL and 2 bands UL CA 46

5.17.1.1 Operating bands for CA 46

5.17.1.2 Channel bandwidths per operating band for CA 46

5.17.1.3 ∆TIB,c and ∆RIB,c values 46

5.18 CA\_n5-n7-n77 47

5.18.1 Common for 1 band UL and 2 bands UL CA 47

5.18.1.1 Operating bands for CA 47

5.18.1.2 Channel bandwidths per operating band for CA 47

5.18.1.3 ∆TIB,c and ∆RIB,c values 47

5.18.2 Specific for 2 bands UL CA 47

5.18.2.1 UE co-existence studies 47

5.18.2.2 REFSENS requirements 48

5.19 CA\_n7-n71-n77 48

5.19.1 Common for 1 band UL and 2 bands UL CA 48

5.19.1.1 Operating bands for CA 48

5.19.1.2 Channel bandwidths per operating band for CA 48

5.19.1.3 ∆TIB,c and ∆RIB,c values 48

5.19.2 Specific for 2 bands UL CA 49

5.19.2.1 UE co-existence studies 49

5.19.2.2 REFSENS requirements 49

5.20 CA\_n48-n70-n77 49

5.20.1 Common for 1 band UL and 2 bands UL CA 49

5.20.1.1 Operating bands for CA 49

5.20.1.2 Channel bandwidths per operating band for CA 50

5.20.1.3 ∆TIB,c and ∆RIB,c values 50

5.20.2 Specific for 2 bands UL CA 50

5.20.2.1 UE co-existence studies 50

5.20.2.2 REFSENS requirements 52

5.21 CA\_n66-n70-n77 52

5.21.1 Common for 1 band UL and 2 bands UL CA 52

5.21.1.1 Operating bands for CA 52

5.21.1.2 Channel bandwidths per operating band for CA 52

5.21.1.3 ∆TIB,c and ∆RIB,c values 52

5.21.2 Specific for 2 bands UL CA 52

5.21.2.1 UE co-existence studies 52

5.21.2.2 REFSENS requirements 54

5.22 CA\_n70-n71-n77 54

5.22.1 Common for 1 band UL and 2 bands UL CA 54

5.22.1.1 Operating bands for CA 54

5.22.1.2 Channel bandwidths per operating band for CA 55

5.22.1.3 ∆TIB,c and ∆RIB,c values 55

5.22.2 Specific for 2 bands UL CA 55

5.22.2.1 UE co-existence studies 55

5.22.2.2 REFSENS requirements 57

5.23 CA\_n1-n3-n38 58

5.23.1 Common for 1 band UL and 2 bands UL CA 58

5.23.1.1 Operating bands for CA 58

5.23.1.2 Channel bandwidths per operating band for CA 58

5.23.1.3 ∆TIB,c and ∆RIB,c values 59

5.24 CA\_n1-n7-n38 59

5.24.1 Common for 1 band UL and 2 bands UL CA 59

5.24.1.1 Operating bands for CA 59

5.24.1.2 Channel bandwidths per operating band for CA 59

5.24.1.3 ∆TIB,c and ∆RIB,c values 60

5.25 CA\_n3-n7-n38 60

5.25.1 Common for 1 band UL and 2 bands UL CA 60

5.25.1.1 Operating bands for CA 60

5.25.1.2 Channel bandwidths per operating band for CA 60

5.25.1.3 ∆TIB,c and ∆RIB,c values 61

5.26 CA\_n3-n28-n38 61

5.26.1 Common for 1 band UL and 2 bands UL CA 61

5.26.1.1 Operating bands for CA 61

5.26.1.2 Channel bandwidths per operating band for CA 61

5.26.1.3 ∆TIB,c and ∆RIB,c values 62

5.27 CA\_n7-n28-n38 62

5.27.1 Common for 1 band UL and 2 bands UL CA 62

5.27.1.1 Operating bands for CA 62

5.27.1.2 Channel bandwidths per operating band for CA 62

5.27.1.3 ∆TIB,c and ∆RIB,c values 63

5.28 CA\_n39-n41-n79 63

5.28.1 Common for 1 band UL and 2 bands UL CA 63

5.28.1.1 Operating bands for CA 63

5.28.1.2 Channel bandwidths per operating band for CA 63

5.28.1.3 ∆TIB,c and ∆RIB,c values 63

5.28.2 Specific for 2 bands UL CA 63

5.28.2.1 UE co-existence studies 63

5.28.2.2 REFSENS requirements 64

5.29 CA\_n1-n3-n40 64

5.29.1 Common for 1 band UL and 2 bands UL CA 64

5.29.1.1 Operating bands for CA 64

5.29.1.2 Channel bandwidths per operating band for CA 64

5.29.1.3 ∆TIB,c and ∆RIB,c values 65

5.29.2 Specific for 2 bands UL CA 65

5.29.2.1 UE co-existence studies 65

5.29.2.2 REFSENS requirements 65

5.30 CA\_n1-n40-n77 65

5.30.1 Common for 1 band UL and 2 bands UL CA 65

5.30.1.1 Operating bands for CA 65

5.30.1.2 Channel bandwidths per operating band for CA 66

5.30.1.3 ∆TIB,c and ∆RIB,c values 67

5.30.2 Specific for 2 bands UL CA 67

5.30.2.1 UE co-existence studies 67

5.30.2.2 REFSENS requirements 67

5.31 CA\_n3-n40-n77 68

5.31.1 Common for 1 band UL and 2 bands UL CA 68

5.31.1.1 Operating bands for CA 68

5.31.1.2 Channel bandwidths per operating band for CA 68

5.31.1.3 ∆TIB,c and ∆RIB,c values 69

5.31.2 Specific for 2 bands UL CA 69

5.31.2.1 UE co-existence studies 69

5.31.2.2 REFSENS requirements 69

5.32 CA\_n28-n40-n77 70

5.32.1 Common for 1 band UL and 2 bands UL CA 70

5.32.1.1 Operating bands for CA 70

5.32.1.2 Channel bandwidths per operating band for CA 70

5.32.1.3 ∆TIB,c and ∆RIB,c values 71

5.32.2 Specific for 2 bands UL CA 71

5.32.2.1 UE co-existence studies 71

5.32.2.2 REFSENS requirements 71

5.33 CA\_n1-n3-n8 72

5.33.1 Common for 1 band UL and 2 bands UL CA 72

5.33.1.1 Operating bands for CA 72

5.33.1.2 Channel bandwidths per operating band for CA 72

5.33.1.3 ∆TIB,c and ∆RIB,c values 72

5.33.2 Specific for 2 bands UL CA 72

5.33.2.1 UE co-existence studies 72

5.33.2.2 REFSENS requirements 72

5.34 CA\_n3-n67-n78 72

5.34.1 Common for 1 band UL and 2 bands UL CA 72

5.34.1.1 Operating bands for CA 72

5.34.1.2 Channel bandwidths per operating band for CA 73

5.34.1.3 ∆TIB,c and ∆RIB,c values 74

5.34.2 Specific for 2 bands UL CA 74

5.34.2.1 UE co-existence studies 74

5.34.2.2 REFSENS requirements 75

5.35 CA\_n3-n20-n28 75

5.35.1 Common for 1 band UL and 2 bands UL CA 75

5.35.1.1 Operating bands for CA 75

5.35.1.2 Channel bandwidths per operating band for CA 75

5.35.1.3 ∆TIB,c and ∆RIB,c values 76

5.35.2 Specific for 2 bands UL CA 76

5.35.2.1 UE co-existence studies 76

5.35.2.2 REFSENS requirements 76

5.36 CA\_n3-n7-n79 76

5.36.1 Common for 1 band UL and 2 bands UL CA 76

5.36.1.1 Operating bands for CA 76

5.36.1.2 Channel bandwidths per operating band for CA 77

5.36.1.3 ∆TIB,c and ∆RIB,c values 77

5.36.1.4 MSD requirement 77

5.37 CA\_n3-n7-n67 78

5.37.1 Common for 1 band UL and 2 bands UL CA 78

5.37.1.1 Operating bands for CA 78

5.37.1.2 Channel bandwidths per operating band for CA 78

5.37.1.3 ∆TIB,c and ∆RIB,c values 79

5.37.2 Specific for 2 bands UL CA 79

5.37.2.1 UE co-existence studies 79

5.37.2.2 REFSENS requirements 79

5.38 CA\_n1-n28-n46 79

5.38.1 Common for 1 band UL and 2 bands UL CA 79

5.38.1.1 Operating bands for CA 79

5.38.1.2 Channel bandwidths per operating band for CA 80

5.38.1.3 ∆TIB,c and ∆RIB,c values 80

5.38.2 Specific for 2 bands UL CA 80

5.38.2.1 Co-existence studies 80

5.38.2.2 REFSENs requirements 81

5.39 CA\_n25-n41-n85 81

5.39.1 Common for 1 band UL and 2 bands UL CA 81

5.39.1.1 Operating bands for CA 81

5.39.1.2 Channel bandwidths per operating band for CA 81

5.39.1.3 ∆TIB,c and ∆RIB,c values 81

5.39.2 Specific for 2 bands UL CA 82

5.39.2.1 UE co-existence studies 82

5.39.2.2 REFSENS requirements 82

5.40 CA\_n25-n77-n85 83

5.40.1 Common for 1 band UL and 2 bands UL CA 83

5.40.1.1 Operating bands for CA 83

5.40.1.2 Channel bandwidths per operating band for CA 83

5.40.1.3 ∆TIB,c and ∆RIB,c values 83

5.40.2 Specific for 2 bands UL CA 83

5.40.2.1 UE co-existence studies 83

5.40.2.2 REFSENS requirements 84

5.41 CA\_n28-n39-n40 84

5.41.1 Common for 1 band UL and 2 bands UL CA 84

5.41.1.1 Operating bands for CA 84

5.41.1.2 Channel bandwidths per operating band for CA 84

5.41.1.3 ∆TIB,c and ∆RIB,c values 84

5.41.2 Specific for 2 bands UL CA 84

5.41.2.1 UE co-existence studies 84

5.41.2.2 REFSENS requirements 85

5.42 CA\_n1-n46-n78 85

5.42.1 Common for 1 band UL and 2 bands UL CA 85

5.42.1.1 Operating bands for CA 85

5.42.1.2 Channel bandwidths per operating band for CA 86

5.42.1.3 ∆TIB,c and ∆RIB,c values 86

5.42.2 Specific for 2 bands UL CA 87

5.42.2.1 Co-existence studies 87

5.42.2.2 REFSENs requirements 87

5.43 CA\_n25-n66-n85 88

5.43.1 Common for 1 band UL and 2 bands UL CA 88

5.43.1.1 Operating bands for CA 88

5.43.1.2 Channel bandwidths per operating band for CA 88

5.43.1.3 ∆TIB,c and ∆RIB,c values 88

5.43.2 Specific for 2 bands UL CA 88

5.43.2.1 UE co-existence studies 88

5.43.2.2 REFSENS requirements 89

5.44 CA\_n3-n7-n67 89

5.44.1 Common for 1 band UL and 2 bands UL CA 89

5.44.1.1 Operating bands for CA 89

5.44.1.2 Channel bandwidths per operating band for CA 89

5.44.1.3 ∆TIB,c and ∆RIB,c values 89

5.44.2 Specific for 2 bands UL CA 90

5.44.2.1 UE co-existence studies 90

5.44.2.2 REFSENS requirements 90

5.45 CA\_n66-n77-n85 91

5.45.1 Common for 1 band UL and 2 bands UL CA 91

5.45.1.1 Operating bands for CA 91

5.45.1.2 Channel bandwidths per operating band for CA 91

5.45.1.3 ∆TIB,c and ∆RIB,c values 91

5.45.2 Specific for 2 bands UL CA 91

5.45.2.1 UE co-existence studies 91

5.45.2.2 REFSENS requirements 92

5.46 CA\_n1-n7-n67 92

5.46.1 Common for 1 band UL and 2 bands UL CA 92

5.46.1.1 Operating bands for CA 92

5.46.1.2 Channel bandwidths per operating band for CA 92

5.46.1.3 ∆TIB,c and ∆RIB,c values 93

5.46.2 Specific for 2 bands UL CA 93

5.46.2.1 UE co-existence studies 93

5.46.2.2 REFSENS requirements 93

5.47 CA\_n1-n67-n78 93

5.47.1 Common for 1 band UL and 2 bands UL CA 93

5.47.1.1 Operating bands for CA 93

5.47.1.2 Channel bandwidths per operating band for CA 94

5.47.1.3 ∆TIB,c and ∆RIB,c values 95

5.47.2 Specific for 2 bands UL CA 95

5.47.2.1 UE co-existence studies 95

5.47.2.2 REFSENS requirements 95

5.48 CA\_n3-n8-n79 95

5.48.1 Common for 1 band UL and 2 bands UL CA 95

5.48.1.1 Operating bands for CA 95

5.48.1.2 Channel bandwidths per operating band for CA 96

5.48.1.3 ∆TIB,c and ∆RIB,c values 96

5.48.2 Specific for 2 bands UL CA 96

5.48.2.1 UE co-existence studies 96

5.48.2.2 REFSENS requirements 96

5.49 CA\_n3-n7-n8 97

5.49.1 Common for 1 band UL and 2 bands UL CA 97

5.49.1.1 Operating bands for CA 97

5.49.1.2 Channel bandwidths per operating band for CA 97

5.49.1.3 ∆TIB,c and ∆RIB,c values 97

5.49.2 Specific for 2 bands UL CA 97

5.49.2.1 UE co-existence studies 97

5.49.2.2 REFSENS requirements 97

5.50 CA\_n8-n39-n41 98

5.50.1 Common for 1 band UL and 2 bands UL CA 98

5.50.1.1 Operating bands for CA 98

5.50.1.2 Channel bandwidths per operating band for CA 98

5.50.1.3 ∆TIB,c and ∆RIB,c values 98

5.50.2 Specific for 2 bands UL CA 98

5.50.2.1 UE co-existence studies 98

5.50.2.2 REFSENS requirements 99

5.51 CA\_n8-n39-n79 99

5.51.1 Common for 1 band UL and 2 bands UL CA 99

5.51.1.1 Operating bands for CA 99

5.51.1.2 Channel bandwidths per operating band for CA 99

5.51.1.3 ∆TIB,c and ∆RIB,c values 99

5.51.2 Specific for 2 bands UL CA 99

5.51.2.1 UE co-existence studies 99

5.51.2.2 REFSENS requirements 99

5.52 CA\_n7-n67-n78 100

5.52.1 Common for 1 band UL and 2 bands UL CA 100

5.52.1.1 Operating bands for CA 100

5.52.1.2 Channel bandwidths per operating band for CA 100

5.52.1.3 ∆TIB,c and ∆RIB,c values 101

5.52.2 Specific for 2 bands UL CA 101

5.52.2.1 UE co-existence studies 101

5.52.2.2 REFSENS requirements 101

5.53 CA\_n41-n66-n85 102

5.53.1 Common for 1 band UL and 2 bands UL CA 102

5.53.1.1 Operating bands for CA 102

5.53.1.2 Channel bandwidths per operating band for CA 102

5.53.1.3 ∆TIB,c and ∆RIB,c values 102

5.53.2 Specific for 2 bands UL CA 103

5.53.2.1 UE co-existence studies 103

5.53.2.2 REFSENS requirements 103

5.54 CA\_n1-n28-n102 103

5.54.1 Common for 1 band UL and 2 bands UL CA 103

5.54.1.1 Operating bands for CA 103

5.54.1.2 Channel bandwidths per operating band for CA 104

5.54.1.3 ∆TIB,c and ∆RIB,c values 104

5.54.2 Specific for 2 bands UL CA 105

5.54.2.1 UE co-existence studies 105

5.54.2.2 REFSENS requirements 107

5.55 CA\_n1-n78-n102 107

5.55.1 Common for 1 band UL and 2 bands UL CA 107

5.55.1.1 Operating bands for CA 107

5.55.1.2 Channel bandwidths per operating band for CA 109

5.55.1.3 ∆TIB,c and ∆RIB,c values 111

5.55.2 Specific for 2 bands UL CA 111

5.55.2.1 UE co-existence studies 111

5.55.2.2 REFSENS requirements 114

5.56 CA\_n7-n78-n102 114

5.56.1 Common for 1 band UL and 2 bands UL CA 114

5.56.1.1 Operating bands for CA 114

5.56.1.2 Channel bandwidths per operating band for CA 116

5.56.1.3 ∆TIB,c and ∆RIB,c values 118

5.56.2 Specific for 2 bands UL CA 118

5.56.2.1 UE co-existence studies 118

5.56.2.2 REFSENS requirements 121

5.57 CA\_n28-n78-n102 121

5.57.1 Common for 1 band UL and 2 bands UL CA 121

5.57.1.1 Operating bands for CA 121

5.57.1.2 Channel bandwidths per operating band for CA 122

5.57.1.3 ∆TIB,c and ∆RIB,c values 124

5.57.2 Specific for 2 bands UL CA 124

5.57.2.1 UE co-existence studies 124

5.57.2.2 REFSENS requirements 127

5.58 CA\_n1-n3-n105 127

5.58.1 Common for 1 band UL and 2 bands UL CA 127

5.58.1.1 Operating bands for CA 127

5.58.1.2 Channel bandwidths per operating band for CA 128

5.58.1.3 ∆TIB,c and ∆RIB,c values 128

5.58.2 Specific for 2 bands UL CA 128

5.58.2.1 UE co-existence studies 128

5.58.2.2 REFSENS requirements 130

5.59 CA\_n1-n40-n105 130

5.59.1 Common for 1 band UL and 2 bands UL CA 130

5.59.1.1 Operating bands for CA 130

5.59.1.2 Channel bandwidths per operating band for CA 131

5.59.1.3 ∆TIB,c and ∆RIB,c values 131

5.59.2 Specific for 2 bands UL CA 131

5.59.2.1 UE co-existence studies 131

5.59.2.2 REFSENS requirements 133

5.60 CA\_n1-n78-n105 133

5.60.1 Common for 1 band UL and 2 bands UL CA 133

5.60.1.1 Operating bands for CA 133

5.60.1.2 Channel bandwidths per operating band for CA 134

5.60.1.3 ∆TIB,c and ∆RIB,c values 134

5.60.2 Specific for 2 bands UL CA 134

5.60.2.1 UE co-existence studies 134

5.60.2.2 REFSENS requirements 136

5.61 CA\_n3-n40-n105 136

5.61.1 Common for 1 band UL and 2 bands UL CA 136

5.61.1.1 Operating bands for CA 136

5.61.1.2 Channel bandwidths per operating band for CA 137

5.61.1.3 ∆TIB,c and ∆RIB,c values 137

5.61.2 Specific for 2 bands UL CA 137

5.61.2.1 UE co-existence studies 137

5.61.2.2 REFSENS requirements 139

5.62 CA\_n3-n78-n105 139

5.62.1 Common for 1 band UL and 2 bands UL CA 139

5.62.1.1 Operating bands for CA 139

5.62.1.2 Channel bandwidths per operating band for CA 140

5.62.1.3 ∆TIB,c and ∆RIB,c values 140

5.62.2 Specific for 2 bands UL CA 140

5.62.2.1 UE co-existence studies 140

5.62.2.2 REFSENS requirements 142

5.63 CA\_n40-n78-n105 142

5.63.1 Common for 1 band UL and 2 bands UL CA 142

5.63.1.1 Operating bands for CA 142

5.63.1.2 Channel bandwidths per operating band for CA 143

5.63.1.3 ∆TIB,c and ∆RIB,c values 143

5.63.2 Specific for 2 bands UL CA 143

5.63.2.1 UE co-existence studies 143

5.63.2.2 REFSENS requirements 145

5.64 CA\_n5-n41-n66 145

5.64.1 Common for 1 band UL and 2 bands UL CA 145

5.64.1.1 Operating bands for CA 145

5.64.1.2 Channel bandwidths per operating band for CA 146

5.64.1.3 ∆TIB,c and ∆RIB,c values 147

5.64.2 Specific for 2 bands UL CA 147

5.64.2.1 UE co-existence studies 147

5.64.2.2 REFSENS requirements 147

5.65 CA\_n2-n5-n41 148

5.65.1 Common for 1 band UL and 2 bands UL CA 148

5.65.1.1 Operating bands for CA 148

5.65.1.2 Channel bandwidths per operating band for CA 148

5.65.1.3 ∆TIB,c and ∆RIB,c values 149

5.65.2 Specific for 2 bands UL CA 149

5.65.2.1 UE co-existence studies 149

5.65.2.2 REFSENS requirements 149

5.66 CA\_n29-n66-n71 149

5.66.1 Common for 1 band UL and 2 bands UL CA 149

5.66.1.1 Operating bands for CA 149

5.66.1.2 Channel bandwidths per operating band for CA 150

5.66.1.3 ∆TIB,c and ∆RIB,c values 150

5.66.2 Specific for 2 bands UL CA 150

5.66.2.1 UE co-existence studies 150

5.66.2.2 REFSENS requirements 151

5.67 CA\_n8-n41-n79 151

5.67.1 Common for 1 band UL and 2 bands UL CA 151

5.67.1.1 Operating bands for CA 151

5.67.1.2 Channel bandwidths per operating band for CA 151

5.67.1.3 ∆TIB,c and ∆RIB,c values 151

5.67.2 Specific for 2 bands UL CA 152

5.67.2.1 UE co-existence studies 152

5.67.2.2 REFSENS requirements 152

5.68 CA\_n28-n39-n79 152

5.68.1 Common for 1 band UL and 2 bands UL CA 152

5.68.1.1 Operating bands for CA 152

5.68.1.2 Channel bandwidths per operating band for CA 152

5.68.1.3 ∆TIB,c and ∆RIB,c values 153

5.68.2 Specific for 2 bands UL CA 153

5.68.2.1 UE co-existence studies 153

5.68.2.2 REFSENS requirements 153

5.69 CA\_n46-n78-n102 153

5.69.1 Common for 1 band UL and 2 bands UL CA 153

5.69.1.1 Operating bands for CA 153

5.69.1.2 Channel bandwidths per operating band for CA 154

5.69.1.3 ∆TIB,c and ∆RIB,c values 158

5.69.2 Specific for 2 bands UL CA 158

5.69.2.1 UE co-existence studies 158

5.69.2.2 REFSENS requirements 160

5.70 CA\_n3-n40-n78 160

5.70.1 Common for 1 band UL and 2 bands UL CA 160

5.70.1.1 Operating bands for CA 160

5.70.1.2 Channel bandwidths per operating band for CA 161

5.70.1.3 ∆TIB,c and ∆RIB,c values 161

5.70.2 Specific for 2 bands UL CA 161

5.70.2.1 UE co-existence studies 161

5.70.2.2 REFSENS requirements 163

5.71 CA\_n2-n71-n77 164

5.71.1 Common for 1 band UL and 2 bands UL CA 164

5.71.1.1 Operating bands for CA 164

5.71.1.2 Channel bandwidths per operating band for CA 164

5.71.1.3 ∆TIB,c and ∆RIB,c values 164

5.71.2 Specific for 2 bands UL CA 164

5.71.2.1 UE co-existence studies 164

5.71.2.2 REFSENS requirements 165

5.72 CA\_n25-n71-n85 165

5.72.1 Common for 1 band UL and 2 bands UL CA 165

5.72.1.1 Operating bands for CA 165

5.72.1.2 Channel bandwidths per operating band for CA 165

5.72.1.3 ∆TIB,c and ∆RIB,c values 165

5.72.2 Specific for 2 bands UL CA 166

5.72.2.1 UE co-existence studies 166

5.72.2.2 REFSENS requirements 166

5.73 CA\_n41-n71-n85 167

5.73.1 Common for 1 band UL and 2 bands UL CA 167

5.73.1.1 Operating bands for CA 167

5.73.1.2 Channel bandwidths per operating band for CA 167

5.73.1.3 ∆TIB,c and ∆RIB,c values 167

5.73.2 Specific for 2 bands UL CA 167

5.73.2.1 UE co-existence studies 167

5.73.2.2 REFSENS requirements 167

5.74 CA\_n66-n71-n85 168

5.74.1 Common for 1 band UL and 2 bands UL CA 168

5.74.1.1 Operating bands for CA 168

5.74.1.2 Channel bandwidths per operating band for CA 168

5.74.1.3 ∆TIB,c and ∆RIB,c values 168

5.74.2 Specific for 2 bands UL CA 168

5.74.2.1 UE co-existence studies 168

5.74.2.2 REFSENS requirements 168

5.75 CA\_n26-n29-n70 169

5.75.1 Common for 1 band UL and 2 bands UL CA 169

5.75.1.1 Operating bands for CA 169

5.75.1.2 Channel bandwidths per operating band for CA 169

5.75.1.3 ∆TIB,c and ∆RIB,c values 169

5.75.2 Specific for 2 bands UL CA 169

5.75.2.1 UE co-existence studies 169

5.75.2.2 REFSENS requirements 170

5.76 CA\_n5-n25-n29 170

5.76.1 Common for 1 band UL and 2 bands UL CA 170

5.76.1.1 Operating bands for CA 170

5.76.1.2 Channel bandwidths per operating band for CA 170

5.76.1.3 ∆TIB,c and ∆RIB,c values 171

5.76.2 Specific for 2 bands UL CA 171

5.76.2.1 UE co-existence studies 171

5.76.2.2 REFSENS requirements 172

5.77 CA\_n7-n12-n71 172

5.77.1 Common for 1 band UL and 2 bands UL CA 172

5.77.1.1 Operating bands for CA 172

5.77.1.2 Channel bandwidths per operating band for CA 172

5.77.1.3 ∆TIB,c and ∆RIB,c values 172

5.77.2 Specific for 2 bands UL CA 172

5.77.2.1 UE co-existence studies 172

5.77.2.2 REFSENS requirements 173

5.78 CA\_n26-n29-n66 173

5.78.1 Common for 1 band UL and 2 bands UL CA 173

5.78.1.1 Operating bands for CA 173

5.78.1.2 Channel bandwidths per operating band for CA 173

5.78.1.3 ∆TIB,c and ∆RIB,c values 173

5.78.2 Specific for 2 bands UL CA 174

5.78.2.1 UE co-existence studies 174

5.78.2.2 REFSENS requirements 174

5.79 CA\_n26-n48-n66 174

5.79.1 Common for 1 band UL and 2 bands UL CA 174

5.79.1.1 Operating bands for CA 174

5.79.1.2 Channel bandwidths per operating band for CA 175

5.79.1.3 ∆TIB,c and ∆RIB,c values 175

5.79.2 Specific for 2 bands UL CA 175

5.79.2.1 UE co-existence studies 175

5.79.2.2 REFSENS requirements 175

5.80 CA\_n26-n48-n70 176

5.80.1 Common for 1 band UL and 2 bands UL CA 176

5.80.1.1 Operating bands for CA 176

5.80.1.2 Channel bandwidths per operating band for CA 176

5.80.1.3 ∆TIB,c and ∆RIB,c values 176

5.80.2 Specific for 2 bands UL CA 177

5.80.2.1 UE co-existence studies 177

5.80.2.2 REFSENS requirements 177

5.81 CA\_n26-n66-n71 177

5.81.1 Common for 1 band UL and 2 bands UL CA 177

5.81.1.1 Operating bands for CA 177

5.81.1.2 Channel bandwidths per operating band for CA 177

5.81.1.3 ∆TIB,c and ∆RIB,c values 177

5.81.2 Specific for 2 bands UL CA 178

5.81.2.1 UE co-existence studies 178

5.81.2.2 REFSENS requirements 178

5.82 CA\_n26-n66-n77 178

5.82.1 Common for 1 band UL and 2 bands UL CA 178

5.82.1.1 Operating bands for CA 178

5.82.1.2 Channel bandwidths per operating band for CA 179

5.82.1.3 ∆TIB,c and ∆RIB,c values 179

5.82.2 Specific for 2 bands UL CA 179

5.82.2.1 UE co-existence studies 179

5.82.2.2 REFSENS requirements 179

5.83 CA\_n26-n70-n77 180

5.83.1 Common for 1 band UL and 2 bands UL CA 180

5.83.1.1 Operating bands for CA 180

5.83.1.2 Channel bandwidths per operating band for CA 180

5.83.1.3 ∆TIB,c and ∆RIB,c values 180

5.83.2 Specific for 2 bands UL CA 181

5.83.2.1 UE co-existence studies 181

5.83.2.2 REFSENS requirements 181

5.84 CA\_n5-n29-n66 182

5.84.1 Common for 1 band UL and 2 bands UL CA 182

5.84.1.1 Operating bands for CA 182

5.84.1.2 Channel bandwidths per operating band for CA 182

5.84.1.3 ∆TIB,c and ∆RIB,c values 182

5.84.2 Specific for 2 bands UL CA 183

5.84.2.1 UE co-existence studies 183

5.84.2.2 REFSENS requirements 184

5.85 CA\_n1-n7-n105 184

5.85.1 Common for 1 band UL and 2 bands UL CA 184

5.85.1.1 Operating bands for CA 184

5.85.1.2 Channel bandwidths per operating band for CA 184

5.85.1.3 ∆TIB,c and ∆RIB,c values 184

5.85.2 Specific for 2 bands UL CA 185

5.85.2.1 UE co-existence studies 185

5.85.2.2 REFSENS requirements 186

5.86 CA\_n3-n7-n105 187

5.86.1 Common for 1 band UL and 2 bands UL CA 187

5.86.1.1 Operating bands for CA 187

5.86.1.2 Channel bandwidths per operating band for CA 187

5.86.1.3 ∆TIB,c and ∆RIB,c values 187

5.86.2 Specific for 2 bands UL CA 188

5.86.2.1 UE co-existence studies 188

5.86.2.2 REFSENS requirements 190

5.87 CA\_n7-n78-n105 190

5.87.1 Common for 1 band UL and 2 bands UL CA 190

5.87.1.1 Operating bands for CA 190

5.87.1.2 Channel bandwidths per operating band for CA 190

5.87.1.3 ∆TIB,c and ∆RIB,c values 190

5.87.2 Specific for 2 bands UL CA 191

5.87.2.1 UE co-existence studies 191

5.87.2.2 REFSENS requirements 193

5.88 CA\_n7-n40-n105 193

5.88.1 Common for 1 band UL and 2 bands UL CA 193

5.88.1.1 Operating bands for CA 193

5.88.1.2 Channel bandwidths per operating band for CA 193

5.88.1.3 ∆TIB,c and ∆RIB,c values 193

5.88.2 Specific for 2 bands UL CA 194

5.88.2.1 UE co-existence studies 194

5.88.2.2 REFSENS requirements 196

5.89 CA\_n12-n71-n77 196

5.89.1 Common for 1 band UL and 2 bands UL CA 196

5.89.1.1 Operating bands for CA 196

5.89.1.2 Channel bandwidths per operating band for CA 196

5.89.1.3 ∆TIB,c and ∆RIB,c values 196

5.89.2 Specific for 2 bands UL CA 197

5.89.2.1 UE co-existence studies 197

5.89.2.2 REFSENS requirements 197

5.90 CA\_n2-n12-n71 198

5.90.1 Common for 1 band UL and 2 bands UL CA 198

5.90.1.1 Operating bands for CA 198

5.90.1.2 Channel bandwidths per operating band for CA 198

5.90.1.3 ∆TIB,c and ∆RIB,c values 198

5.90.2 Specific for 2 bands UL CA 198

5.90.2.1 UE co-existence studies 198

5.90.2.2 REFSENS requirements 199

5.91 CA\_n34-n39-n40 199

5.91.1 Common for 1 band UL and 2 bands UL CA 199

5.91.1.1 Operating bands for CA 199

5.91.1.2 Channel bandwidths per operating band for CA 199

5.91.1.3 ∆TIB,c and ∆RIB,c values 199

5.91.2 Specific for 2 bands UL CA 200

5.91.2.1 UE co-existence studies 200

5.91.2.2 REFSENS requirements 200

5.92 CA\_n3-n7-n20 200

5.92.1 Common for 1 band UL and 2 bands UL CA 200

5.92.1.1 Operating bands for CA 200

5.92.1.2 Channel bandwidths per operating band for CA 200

5.92.1.3 ∆TIB,c and ∆RIB,c values 201

5.92.2 Specific for 2 bands UL CA 201

5.92.2.1 UE co-existence studies 201

5.92.2.2 REFSENS requirements 201

5.93 CA\_n3-n20-n78 201

5.93.1 Common for 1 band UL and 2 bands UL CA 201

5.93.1.1 Operating bands for CA 201

5.93.1.2 Channel bandwidths per operating band for CA 202

5.93.1.3 ∆TIB,c and ∆RIB,c values 203

5.93.2 Specific for 2 bands UL CA 203

5.93.2.1 UE co-existence studies 203

5.93.2.2 REFSENS requirements 203

5.94 CA\_n7-n20-n67 204

5.94.1 Common for 1 band UL and 2 bands UL CA 204

5.94.1.1 Operating bands for CA 204

5.94.1.2 Channel bandwidths per operating band for CA 204

5.94.1.3 ∆TIB,c and ∆RIB,c values 205

5.94.2 Specific for 2 bands UL CA 205

5.94.2.1 UE co-existence studies 205

5.94.2.2 REFSENS requirements 205

5.95 CA\_n7-n20-n78 205

5.95.1 Common for 1 band UL and 2 bands UL CA 205

5.95.1.1 Operating bands for CA 205

5.95.1.2 Channel bandwidths per operating band for CA 206

5.95.1.3 ∆TIB,c and ∆RIB,c values 207

5.95.2 Specific for 2 bands UL CA 207

5.95.2.1 UE co-existence studies 207

5.95.2.2 REFSENS requirements 207

5.96 CA\_n20-n67-n78 208

5.96.1 Common for 1 band UL and 2 bands UL CA 208

5.96.1.1 Operating bands for CA 208

5.96.1.2 Channel bandwidths per operating band for CA 208

5.96.1.3 ∆TIB,c and ∆RIB,c values 209

5.96.2 Specific for 2 bands UL CA 209

5.96.2.1 UE co-existence studies 209

5.96.2.2 REFSENS requirements 209

5.97 CA\_n5-n28-n79 209

5.97.1 Common for 1 band UL and 2 bands UL CA 209

5.97.1.1 Operating bands for CA 209

5.97.1.2 Channel bandwidths per operating band for CA 210

5.97.1.3 ∆TIB,c and ∆RIB,c values 211

5.97.2 Specific for 2 bands UL CA 211

5.97.2.1 UE co-existence studies 211

5.97.2.2 REFSENS requirements 211

5.98 CA\_n26-n70-n71 211

5.98.1 Common for 1 band UL and 2 bands UL CA 211

5.98.1.1 Operating bands for CA 211

5.98.1.2 Channel bandwidths per operating band for CA 211

5.98.1.3 ∆TIB,c and ∆RIB,c values 212

5.98.2 Specific for 2 bands UL CA 212

5.98.2.1 UE co-existence studies 212

5.98.2.2 REFSENS requirements 212

5.99 CA\_n1-n5-n79 212

5.99.1 Common for 1 band UL and 2 bands UL CA 212

5.99.1.1 Operating bands for CA 212

5.99.1.2 Channel bandwidths per operating band for CA 212

5.99.1.3 ∆TIB,c and ∆RIB,c values 213

5.99.2 Specific for 2 bands UL CA 213

5.99.2.1 UE co-existence studies 213

5.99.2.2 REFSENS requirements 213

5.100 CA\_n3-n5-n28 214

5.100.1 Common for 1 band UL and 2 bands UL CA 214

5.100.1.1 Operating bands for CA 214

5.100.1.2 Channel bandwidths per operating band for CA 214

5.100.1.3 ∆TIB,c and ∆RIB,c values 215

5.100.2 Specific for 2 bands UL CA 215

5.100.2.1 UE co-existence studies 215

5.100.2.2 REFSENS requirements 215

5.101 CA\_n3-n5-n79 215

5.101.1 Common for 1 band UL and 2 bands UL CA 215

5.101.1.1 Operating bands for CA 215

5.101.1.2 Channel bandwidths per operating band for CA 215

5.101.1.3 ∆TIB,c and ∆RIB,c values 216

5.101.2 Specific for 2 bands UL CA 216

5.101.2.1 UE co-existence studies 216

5.101.2.2 REFSENS requirements 216

5.102 CA\_n5-n78-n79 217

5.102.1 Common for 1 band UL and 2 bands UL CA 217

5.102.1.1 Operating bands for CA 217

5.102.1.2 Channel bandwidths per operating band for CA 217

5.102.1.3 ∆TIB,c and ∆RIB,c values 218

5.102.2 Specific for 2 bands UL CA 218

5.102.2.1 UE co-existence studies 218

5.102.2.2 REFSENS requirements 219

5.103 CA\_n5-n28-n78 219

5.103.1 Common for 1 band UL and 2 bands UL CA 219

5.103.1.1 Operating bands for CA 219

5.103.1.2 Channel bandwidths per operating band for CA 219

5.103.1.3 ∆TIB,c and ∆RIB,c values 220

5.103.2 Specific for 2 bands UL CA 220

5.103.2.1 UE co-existence studies 220

5.103.2.2 REFSENS requirements 220

5.104 CA\_n34-n39-n41 221

5.104.1 Common for 1 band UL and 2 bands UL CA 221

5.104.1.1 Operating bands for CA 221

5.104.1.2 Channel bandwidths per operating band for CA 221

5.104.1.3 ∆TIB,c and ∆RIB,c values 221

5.104.2 Specific for 2 bands UL CA 221

5.104.2.1 UE co-existence studies 221

5.104.2.2 REFSENS requirements 222

5.105 CA\_n34-n40-n41 222

5.105.1 Common for 1 band UL and 2 bands UL CA 222

5.105.1.1 Operating bands for CA 222

5.105.1.2 Channel bandwidths per operating band for CA 222

5.105.1.3 ∆TIB,c and ∆RIB,c values 222

5.105.2 Specific for 2 bands UL CA 222

5.105.2.1 UE co-existence studies 222

5.105.2.2 REFSENS requirements 223

5.106 CA\_n34-n41-n79 223

5.106.1 Common for 1 band UL and 2 bands UL CA 223

5.106.1.1 Operating bands for CA 223

5.106.1.2 Channel bandwidths per operating band for CA 223

5.106.1.3 ∆TIB,c and ∆RIB,c values 223

5.106.2 Specific for 2 bands UL CA 224

5.106.2.1 UE co-existence studies 224

5.106.2.2 REFSENS requirements 224

5.107 CA\_n1-n5-n28 225

5.107.1 Common for 1 band UL and 2 bands UL CA 225

5.107.1.1 Operating bands for CA 225

5.107.1.2 Channel bandwidths per operating band for CA 225

5.107.1.3 ∆TIB,c and ∆RIB,c values 226

5.107.2 Specific for 2 bands UL CA 226

5.107.2.1 UE co-existence studies 226

5.107.2.2 REFSENS requirements 226

5.108 CA\_n1-n5-n40 227

5.108.1 Common for 1 band UL and 2 bands UL CA 227

5.108.1.1 Operating bands for CA 227

5.109 CA\_n5-n7-n25 228

5.109.1 Common for 1 band UL and 2 bands UL CA 228

5.109.1.1 Operating bands for CA 228

5.109.1.2 Channel bandwidths per operating band for CA 228

5.109.1.3 ∆TIB,c and ∆RIB,c values 228

5.109.2 Specific for 2 bands UL CA 229

5.109.2.1 UE co-existence studies 229

5.109.2.2 REFSENS requirements 233

5.110 CA\_n5-n7-n66 233

5.110.1 Common for 1 band UL and 2 bands UL CA 233

5.110.1.1 Operating bands for CA 233

5.110.1.2 Channel bandwidths per operating band for CA 233

5.110.1.3 ∆TIB,c and ∆RIB,c values 233

5.110.2 Specific for 2 bands UL CA 234

5.110.2.1 UE co-existence studies 234

5.110.2.2 REFSENS requirements 238

5.111 CA\_n5-n25-n41 238

5.111.1 Common for 1 band UL and 2 bands UL CA 238

5.111.1.1 Operating bands for CA 238

5.111.1.2 Channel bandwidths per operating band for CA 238

5.111.1.3 ∆TIB,c and ∆RIB,c values 238

5.111.2 Specific for 2 bands UL CA 239

5.111.2.1 UE co-existence studies 239

5.111.2.2 REFSENS requirements 243

5.112 CA\_n5-n41-n77 243

5.112.1 Common for 1 band UL and 2 bands UL CA 243

5.112.1.1 Operating bands for CA 243

5.112.1.2 Channel bandwidths per operating band for CA 243

5.112.1.3 ∆TIB,c and ∆RIB,c values 243

5.112.2 Specific for 2 bands UL CA 244

5.112.2.1 UE co-existence studies 244

5.112.2.2 REFSENS requirements 248

5.113 CA\_n25-n41-n66 249

5.113.1.2 Channel bandwidths per operating band for CA 249

5.113.2 Specific for 2 bands UL CA 249

5.113.2.1 UE co-existence studies 249

5.113.2.2 REFSENS requirements 250

5.114 CA\_n25-n41-n71 251

5.114.1.2 Channel bandwidths per operating band for CA 251

5.114.2 Specific for 2 bands UL CA 251

5.114.2.1 UE co-existence studies 251

5.114.2.2 REFSENS requirements 252

6 Dual Connectivity: Specific Band Combination Part 252

6.x DC\_nX-nY-nZ 252

6.x.1 Configurations for DC\_nX-nY-nZ 252

6.1 DC\_n3-n67-n78 252

6.1.1 Configurations for DC\_n3-n67-n78 252

6.2 DC\_n3-n7-n67 253

6.2.1 Configurations for DC\_n3-n7-n67 253

6.3 DC\_n1-n28-n46 253

6.3.1 Configurations for DC\_n1-n28-n46 253

6.4 DC\_n1-n46-n78 253

6.4.1 Configurations for DC\_n1-n46-n78 253

6.5 DC\_n1-n7-n67 253

6.5.1 Configurations for DC\_n1-n7-n67 253

6.6 DC\_n1-n67-n78 254

6.6.1 Configurations for DC\_n1-n67-n78 254

6.7 DC\_n7-n67-n78 254

6.7.1 Configurations for DC\_n7-n67-n78 254

6.8 DC\_n1-n28-n102 254

6.8.1 Configurations for DC\_n1-n28-n102 254

6.9 DC\_n1-n78-n102 255

6.9.1 Configurations for DC\_n1-n78-n102 255

6.10 DC\_n7-n78-n102 255

6.10.1 Configurations for DC\_n7-n78-n102 255

6.11 DC\_n28-n78-n102 256

6.11.1 Configurations for DC\_n28-n78-n102 256

6.12 DC\_ n3-n7-n20 256

6.12.1 Configurations for DC\_n3-n7-n20 256

6.13 DC\_ n3-n20-n78 256

6.13.1 Configurations for DC\_n3-n20-n78 256

6.14 DC\_ n7-n20-n67 256

6.14.1 Configurations for DC\_n7-n20-n67 256

6.15 DC\_ n7-n20-n78 257

6.15.1 Configurations for DC\_n7-n20-n78 257

6.16 DC\_ n20-n67-n78 257

6.16.1 Configurations for DC\_n20-n67-n78 257

Annex <X> (informative): Change history 258

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**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The present document is a technical report for power class 3 NR inter-band CA and DC for 3 bands DL with up to 2 bands UL under Rel-18 time frame. The purpose is to gather the relevant background information and studies in order to address NR inter-band CA and DC for 3 bands DL with up to 2 bands UL for the Rel-18 band combinations.

This TR contains the RF requirements of 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 TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[3] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[4] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms 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.

**Inter-band carrier aggregation:** Carrier aggregation of component carriers in 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:

ΔRIB,c Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell *c*

ΔTIB,c Allowed maximum configured output power relaxation due to support for inter-band CA operation, inter-band NR-DC operation and due to support for SUL operations, for serving cell *c*

## 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].

BS Base Station

CA Carrier Aggregation

DC Dual Connectivity

DL DownLink

FDD Frequency Division Duplex

IMD Inter-modulation

MSD Maximum Sensitivity Deduction

SCS Subcarrier spacing

TDD Time Division Duplex

UE User Equipment

UL UpLink

# 4 Background

## 4.1 Introduction

The present document is a technical report for NR inter-band CA and DC for 3 bands DL with up to 2 bands UL under Rel-18 time frame. The document covers the RF requirements for each band combination specific issues (i.e. one sub-clause defined per band combination) including:

1: Common issues for both 1 band UL and 2 bands UL NR CA, including ∆TIB and ∆RIB requirements.

2: 2 bands UL NR CA specific issues, including MSD caused by IMD issue, etc.

It shall be noted that no new issue for inter-band NR DC combination, and the 2 bands UL NR CA specific issues shall be re-used.

## 4.2 TR Maintenance

A single company is responsible for introducing all approved TPs in the current TR, i.e. TR editor. However, it is the responsibility of the contact person of each band combination to ensure that the TPs related to the band combination have been implemented.

Editor's note: It is not recommended to bring TP to TR for the following cases:

1. NR CA configurations with additional BCS other than BCS0 (such as BCS1) if there is no additional technical issue.

2. High order DL NR CA configurations, such as DL NR CA configuration CA\_nXA-nYA-nZC

# 5 Both bands within FR1 Carrier Aggregation: Specific Band Combination Part

## 5.x CA\_nX-nY-nZ

### 5.x.1 Common for 1 band UL and 2 bands UL CA

#### 5.x.1.1 Operating bands for CA

Table 5.x.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| nX |  | – |  |  | – |  |  |
| nY |  | – |  |  | – |  |  |
| nZ |  | – |  |  | – |  |  |

#### 5.x.1.2 Channel bandwidths per operating band for CA

Table 5.x.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_nXA-nYA-nZA | -\*  or  CA\_nXA-nYA  CA\_nXA-nZA  CA\_nYA-nZA | nX | 5, 10, 15, 20 | 0 |
|  |  | nY | 5, 10, 15, 20, 25, 30 |  |
|  |  | nZ | 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

Editor's note\*: ‘-’ is for 1UL

Editor's note: The table format can be referred to Table 5.5A.3.2-1 in TS38.101-1

#### 5.x.1.3 ∆TIB,c and ∆RIB,c values

Editor’s note: for the table of ∆TIB,c and ∆RIB,c values, please use the same table format as in the latest TS 38.101-1, the table below is from the latest Rel.18 38.101-1.

For CA\_nX-nY-nZ, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.x.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_nx-ny-nz |  |  |  |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.x.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_nx-ny-nz |  |  |  |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.x.2 Specific for 2 bands UL CA

Editor's note: Text will be added if 2 bands UL CA are supported, otherwise all the clauses shall be void.

#### 5.x.2.1 UE co-existence studies

Editor's note: Co-existence study tables are recommended to be included for the third band, since IMD study only have been incorporated in the corresponding 2DL fallback band combination TR.

Based on Table 5.x.2.2-1, nth order IMD from band nX and Band nY may also fall into Rx frequencies of band nZ.

Table 5.x.2.2-1 lists Band nX + Band nY 2UL bands CA 1st order triple beat (IMD3) related to 2UL band 3CC (one band support intra-band ULCA) for the UE-to-UE coexistence analysis into the third receive band of Band nZ, where Band nX is the uplink band supporting two uplink carriers and Band nY is the single uplink carrier.

In this Release only contiguous UL CA in one band is supported, thus minimum and maximum channel separation in Table 5.x.2.3-1 is equal to minimum and maximum aggregated bandwidth respectively.

If non-contiguous UL-CA in one band is supported, minimum and maximum channel separation in Table 5.x.2.3-1 is equal to minimum and maximum bandwidth separation respectively.

**Table 5.x.2.2-1: Band nX and Band nY triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | - | - | - | - |  | . |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | - | - | - | - |  | - |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | - | - | - | - |  | - |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | - | - | - | - |  |  |

Based on Table 5.x.2.2-1, 1st order triple beat IMD may also fall into Rx frequencies of bands nZ.

If, for the same 2UL bands, an IMD3 also falls into the same Rx frequencies of bands nZ based on Table 5.x.2.1-1analysis, the corresponding triple beat IMD3 can be ignored.

Guidelines on triple-beat analysis can be found in TR 38.846, clause 7.4.

#### 5.x.2.2 REFSENS requirements

Editor's note: Text will be added on reference sensitivity exceptions if IMD issue due to dual uplink with one uplink carrier per band operation or tiple beat due to 2 band UL with three uplink carriers falling into DL of the third band are identified.

## 5.1 CA\_n1-n41-n79

### 5.1.1 Common for 1 band UL and 2 bands UL CA

#### 5.1.1.1 Operating bands for CA

Table 5.1.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.1.1.2-1: Supported bandwidths per CA band combination of band n1+n41+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n41A-n79A | CA\_n1A-n41A  CA\_n1A-n79A  CA\_n41A-n79A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n41 | 10, 15, 20 30, 40, 50, 60, 80, 90, 100 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |

#### 5.1.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n41-n79, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.1.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n41-n79 | 0.5 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.1.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n41-n79 | - | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.1.2 Specific for 2 bands UL CA

#### 5.1.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations such as CA n1-n41, CA\_n1-n79 and n41-n79 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings.

– 2nd and 5th order IMD generated by dual uplink of Band n1 + Band n41 may fall into own Rx of Band n79.

– 2nd and 5th order IMD generated by dual uplink of Band n1 + Band n79 may fall into own Rx of Band n41.

– 2nd and 5th order IMD generated by dual uplink of Band n41 + Band n79 may fall into own Rx of Band n1.

#### 5.1.2.2 REFSENS requirements

Table 5.1.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band.

Table 5.1.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n41-n79 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n41 | 2530 | 10 | 50 | 2530 | N/A | TDD | N/A |
|  | n79 | 4500 | 40 | 216 | 4500 | 19.0 | TDD | IMD21 |
|  | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n79 | 4500 | 40 | 216 | 4500 | N/A | TDD | N/A |
|  | n41 | 2530 | 10 | 50 | 2530 | 29.4 | TDD | IMD21 |
|  | n41 | 2530 | 10 | 50 | 2530 | N/A | TDD | N/A |
|  | n79 | 4690 | 40 | 216 | 4690 | N/A | TDD | N/A |
|  | n1 | 1970 | 5 | 25 | 2160 | 29.9 | FDD | IMD21 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.2 CA\_n41-n77-n79

### 5.2.1 Common for 1 band UL and 2 bands UL CA

#### 5.2.1.1 Operating bands for CA

Table 5.2.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.2.1.2-1: Supported bandwidths per CA band combination of band n41+n77+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n41A-n77A-n79A | CA\_n41A-n77A  CA\_n41A-n79A  CA\_n77A-n79A | n41 | 10, 15, 20, 30, 40, 50, 60, 80, 90, 100 | 0 |
|  |  | n77 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |
| CA\_n41A-n77(2A)-n79A | CA\_n41A-n77A  CA\_n41A-n79A  CA\_n77A-n79A | n41 | 10, 15, 20, 30, 40, 50, 60, 80, 90, 100 | 0 |
|  |  | n77 | CA\_n77(2A)\_BCS0 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |

#### 5.2.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n41-n77-n79, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.2.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n41-n77-n79 | 0.3 | 0.8 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.2.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n41-n77-n79 | 0.5 | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.2.2 Specific for 2 bands UL CA

#### 5.2.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations such as CA n41-n77, CA\_n41-n79 and n77-n79 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings. Note that there is no IMD impact on CA\_n41-n77 to n79 Rx and that on CA\_n41-n79 to n77 Rx since CA\_n77-n79 is synchronous operation.

– 3rd, 4th and 5th order IMD generated by dual uplink of Band n77 + Band n79 may fall into own Rx of Band n41.

#### 5.2.2.2 REFSENS requirements

Table 5.2.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band.

Table 5.2.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n41-n77-n79 | n77 | 3600 | 10 | 50 | 3600 | N/A | TDD | N/A |
|  | n79 | 4600 | 40 | 216 | 4600 | N/A | TDD | N/A |
|  | n41 | 2600 | 10 | 50 | 2600 | 10.7 | TDD | IMD31,2 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.3 CA\_n3-n28-n40

### 5.3.1 Common for 1 band UL and 2 bands UL CA

#### 5.3.1.1 Operating bands for CA

Table 5.3.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |
| --- | --- | --- |
| **NR CA Band** | **NR Band**  **(Table 5.2-1)** | **DL interruption allowed**  **(Note 4)** |
| CA\_n3-n28-n403 | n3, n28, n40 |  |
| NOTE 3: Applicable for UE supporting inter-band carrier aggregation with mandatory simultaneous Rx/Tx capability | | |

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

Table 5.3.1.2-1: Supported bandwidths per CA band combination of band n3+n28+n40

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n3A-n28A-n40A | CA\_n3A-n28A  CA\_n3A-n40A  CA\_n28A-n40A | n3 | 5, 10, 15, 20 | 0 |
|  |  | n28 | 5, 10 |  |
|  |  | n40 | 20, 40 |  |

#### 5.3.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n28-n40, the ΔTIB,c and ΔRIB,c values are given in the tables below, reuse the values of CA\_3-28-40.

Table 5.3.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n28-n40 | 0.5 | 0.3 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.3.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n28-n40 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.3.2 Specific for 2 bands UL CA

#### 5.3.2.1 UE co-existence studies

For CA combinations with 3 bands DL and 2bands UL, only IMD issues due to dual Tx operation of two bands falling to the third band Rx need to be considered.

Based on the calculation, there is no additional IMD issue.

#### 5.3.2.2 REFSENS requirements

Based on co-existence studies on 5.3.2.1, no need to define exceptional REFSENS requirements.

## 5.4 CA\_n3-n8-n41

### 5.4.1 Common for 1 band UL and 2 bands UL CA

#### 5.4.1.1 Operating bands for CA

Table 5.4.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

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

Table 5.4.1.2-1: Supported bandwidths per CA band combination of band n3+n8+n41

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n8A-n41A | CA\_n3A-n8A  CA\_n3A-n41A  CA\_n8A-n41A | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n8 | 5, 10, 15, 20 |  |
|  |  | n41 | 10, 15, 20, 30, 40, 50, 60, 80, 90, 100 |  |

#### 5.4.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3A-n8A-n41A, the ΔTIB,c and ΔRIB,c values have already been included in the TS38.101-1.

### 5.4.2 Specific for 2 bands UL CA

#### 5.4.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n3A-n8A, CA\_n3A-n41A and CA\_n8A-n41A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD 2 and IMD3 caused by n3+n8 may fall into the its own band n41 Rx

IMD 2 and IMD3 caused by n3+n41 may fall into the its own band n8 Rx

IMD2 caused by n8+n41 may fall into the its own band n3 Rx

#### 5.4.2.2 REFSENS requirements

For IMD2 caused by n8+n41, the IMD2 frequency range is calculated by the lower edge and upper edge of the bands, which is 1581MHz~1810MHz (i.e. f41-f8) , while the band n3 DL frequency range is 1805MHz~1880MHz, the overlapping frequency range is only 5MHz. However, considering the minimum channel bandwidths of band n8 and n41, which are 5MHz and 10MHz, respectively. The IMD2 frequency range is 1588.5 MHz ~ 1802.5 MHz, which means there are no test points of the IMD2 product fall into the own band n3 DL frequency range. Therefore, there is no need to define such MSD values.

For the other IMDs, the MSD requirement are defined in table 5.4.2.2-1:

Table 5.4.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n8-n41 | n3 | 1722.5 | 5 | 25 | 1817.5 | N/A | FDD | N/A |
|  | n8 | 887.5 | 5 | 25 | 932.5 | N/A | FDD | N/A |
|  | n41 | 2610 | 10 | 50 | 2610 | 28.0 | FDD | IMD24 |
|  | n3 | 1725 | 5 | 25 | 1820 | N/A | FDD | N/A |
|  | n8 | 900 | 5 | 25 | 945 | 26.0 | FDD | IMD24 |
|  | n41 | 2516 | 10 | 50 | 2516 | N/A | FDD | N/A |
| NOTE 4: This band is subject to IMD3 also which MSD is not specified. | | | | | | | | |

## 5.5 CA\_n1-n3-n26

### 5.5.1 Common for 1 band UL and 2 bands UL CA

#### 5.5.1.1 Operating bands for CA

Table 5.5.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n26 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |

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

Table 5.5.1.2-1: Supported bandwidths per CA band combination of band n1+n3+n26

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n26A | CA\_n1A-n3A  CA\_n1A-n26A  CA\_n3A-n26A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n26 | 5, 10, 15, 20 |  |

#### 5.5.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n3-n26, the ΔTIB,c and ΔRIB,c values are reused from CA\_1-3-26 and are given in the tables below.

Table 5.5.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n3-n26 | 0.3 | 0.3 | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.5.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n3-n26 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.5.2 Specific for 2 bands UL CA

#### 5.5.2.1 UE co-existence studies

UL n1-n26 does not affect DL n3.

UL n3-n26 does not affect DL n1.

UL n1-n3 does not affect DL n26.

#### 5.5.2.2 REFSENS requirements

Based on the co-existence studies there are no need to defined MSD values.

## 5.6 CA\_n1-n26-n78

### 5.6.1 Common for 1 band UL and 2 bands UL CA

#### 5.6.1.1 Operating bands for CA

Table 5.6.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n26-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.6.1.2-1: Supported bandwidths per CA band combination of band n1+n26+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n26A-n78A | CA\_n1A-n26A  CA\_n1A-n78A  CA\_n26A-n78A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n26 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.6.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n26-n78, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n5-n78 and are given in the tables below.

Table 5.6.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n26-n78 | 0.6 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.6.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n26-n78 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.6.2 Specific for 2 bands UL CA

#### 5.6.2.1 UE co-existence studies

UL n1-n26 gives IMD3 into DL n78.

UL n1-n78 gives IMD5 into DL n26.

UL n26-n78 gives IMD3 into DL n1.

#### 5.6.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_n1-n5-n78 are reused.

Table 5.6.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n26-n78 | n1 | 1932 | 5 | 25 | 2122 | 18.1 | FDD | IMD3 |
|  | n26 | 829 | 5 | 25 | 874 | N/A | FDD | N/A |
|  | n78 | 3780 | 10 | 50 | 3780 | N/A | TDD | N/A |
|  | n1 | 1975 | 5 | 25 | 2165 | N/A | FDD | N/A |
|  | n26 | 840 | 5 | 25 | 885 | 3.1 | FDD | IMD5 |
|  | n78 | 3405 | 10 | 50 | 3405 | N/A | TDD | N/A |
|  | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n26 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n78 | 3610 | 10 | 50 | 3610 | 15.7 | TDD | IMD3 |

## 5.7 CA\_n3-n26-n78

### 5.7.1 Common for 1 band UL and 2 bands UL CA

#### 5.7.1.1 Operating bands for CA

Table 5.7.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n26-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.7.1.2-1: Supported bandwidths per CA band combination of band n3+n26+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n26A-n78A | CA\_n3A-n26A  CA\_n3A-n78A  CA\_n26A-n78A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n26 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.7.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n26-n78, the ΔTIB,c and ΔRIB,c values are reused from CA\_n3-n5-n78 and are given in the tables below.

Table 5.7.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n26-n78 | 0.6 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.7.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n26-n78 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.7.2 Specific for 2 bands UL CA

#### 5.7.2.1 UE co-existence studies

UL n3-n26 gives IMD3 and IMD5 into DL n78.

UL n3-n78 gives no IMD into DL n26.

UL n26-n78 gives IMD3 into DL n3.

#### 5.7.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_n3-n5-n78 are reused.

Table 5.7.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n26-n78 | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n26 | 839 | 5 | 25 | 884 | N/A | FDD | N/A |
|  | n78 | 3408 | 10 | 50 | 3408 | 16.1 | TDD | IMD3 |
|  | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n26 | 839 | 5 | 25 | 884 | N/A | FDD | N/A |
|  | n78 | 3512 | 10 | 50 | 3512 | 4.5 | TDD | IMD5 |
|  | n3 | 1767 | 5 | 25 | 1862 | 15.7 | FDD | IMD3 |
|  | n26 | 839 | 5 | 25 | 884 | N/A | FDD | N/A |
|  | n78 | 3540 | 10 | 50 | 3540 | N/A | TDD | N/A |

## 5.8 CA\_n1-n7-n26

### 5.8.1 Common for 1 band UL and 2 bands UL CA

#### 5.8.1.1 Operating bands for CA

Table 5.8.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n7-n26 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |

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

Table 5.8.1.2-1: Supported bandwidths per CA band combination of band n1+n7+n26

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n7A-n26A | CA\_n1A-n26A  CA\_n1A-n7A  CA\_n7A-n26A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n26 | 5, 10, 15, 20 |  |
| CA\_n1A-n7B-n26A | CA\_n1A-n26A  CA\_n1A-n7A  CA\_n7A-n26A  CA\_n7B | n1 | 5, 10, 15, 20 | 0 |
|  |  | n7 | CA\_n7B\_BCS0 |  |
|  |  | n26 | 5, 10, 15, 20 |  |

#### 5.8.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n7-n26, the ΔTIB,c and ΔRIB,c values are reused from CA\_1-3-26 and are given in the tables below.

Table 5.8.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n7-n26 | 0.5 | 0.6 | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.8.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n7-n26 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.8.2 Specific for 2 bands UL CA

#### 5.8.2.1 UE co-existence studies

UL n1-n7 gives IMD5 into DL n26.

UL n1-n26 does not affect DL n7.

UL n7-n26 does not affect DL n1.

#### 5.8.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_1-7-26 are reused.

Table 5.8.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n7-n26 | n1 | 1965 | 5 | 25 | 2155 | N/A | FDD | N/A |
|  | n7 | 2510 | 10 | 50 | 2630 | N/A | FDD | N/A |
|  | n26 | 830 | 5 | 50 | 875 | 3.5 | FDD | IMD5 |

## 5.9 CA\_n3-n7-n26

### 5.9.1 Common for 1 band UL and 2 bands UL CA

#### 5.9.1.1 Operating bands for CA

Table 5.9.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n7-n26 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |

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

Table 5.9.1.2-1: Supported bandwidths per CA band combination of band n3+n7+n26

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n7A-n26A | CA\_n3A-n26A  CA\_n3A-n7A  CA\_n7A-n26A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n26 | 5, 10, 15, 20 |  |
| CA\_n3A-n7B-n26A | CA\_n3A-n26A  CA\_n3A-n7A  CA\_n7A-n26A  CA\_n7B | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n7 | CA\_n7B\_BCS0 |  |
|  |  | n26 | 5, 10, 15, 20 |  |

#### 5.9.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n7-n26, the ΔTIB,c and ΔRIB,c values are reused from CA\_1-3-26 and are given in the tables below.

Table 5.9.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n7-n26 | 0.5 | 0.5 | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.9.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n7-n26 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.9.2 Specific for 2 bands UL CA

#### 5.9.2.1 UE co-existence studies

UL n3-n7 gives IMD3 into DL n26.

UL n3-n26 gives IMD2 and IMD3 into DL n7.

UL n7-n26 does not affect DL n3.

#### 5.9.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_3-7-26 are reused.

Table 5.9.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n7-n26 | n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
|  | n7 | 2560 | 10 | 50 | 2680 | N/A | FDD | N/A |
|  | n26 | 835 | 5 | 25 | 880 | 17.5 | FDD | IMD3 |
|  | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
|  | n7 | 2505 | 10 | 50 | 2625 | 29.0 | FDD | IMD24 |
|  | n26 | 845 | 5 | 25 | 890 | N/A | FDD | N/A |
| NOTE 4: This band is subject to IMD3 also which MSD is not specified | | | | | | | | |

## 5.10 CA\_n7-n26-n78

### 5.10.1 Common for 1 band UL and 2 bands UL CA

#### 5.10.1.1 Operating bands for CA

Table 5.10.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n26-n78 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.10.1.2-1: Supported bandwidths per CA band combination of band n7+n26+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n26A-n78A | CA\_n7A-n26A  CA\_n7A-n78A  CA\_n26A-n78A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n26 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n7B-n26A-n78A | CA\_n7A-n26A  CA\_n7A-n78A  CA\_n26A-n78A  CA\_n7B | n7 | CA\_n7B\_BCS0 | 0 |
|  |  | n26 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.10.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n26-n78, the ΔTIB,c and ΔRIB,c values are reused from CA\_n5-n7-n78 and are given in the tables below.

Table 5.10.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7-n26-n78 | 0.6 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.10.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7-n26-n78 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.10.2 Specific for 2 bands UL CA

#### 5.10.2.1 UE co-existence studies

UL n7-n26 gives IMD2 into DL n78.

UL n7-n78 gives IMD2 and IMD5 into DL n26.

UL n26-n78 gives IMD2 into DL n7.

#### 5.10.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_n5-n7-n78 are reused.

Table 5.10.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n26-n78 | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
|  | n26 | 834 | 5 | 25 | 879 | 30.2 | FDD | IMD2 |
|  | n78 | 3429 | 10 | 50 | 3429 | N/A | TDD | N/A |
|  | n7 | 2525 | 5 | 25 | 2645 | N/A | FDD | N/A |
|  | n26 | 830 | 5 | 25 | 875 | 3.3 | FDD | IMD5 |
|  | n78 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |
|  | n7 | 2525 | 5 | 25 | 2645 | 30.1 | FDD | IMD2 |
|  | n26 | 844 | 5 | 25 | 889 | N/A | FDD | N/A |
|  | n78 | 3489 | 10 | 50 | 3489 | N/A | TDD | N/A |
|  | n7 | 2540 | 5 | 25 | 2660 | N/A | FDD | N/A |
|  | n26 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
|  | n78 | 3375 | 10 | 50 | 3375 | 29.7 | TDD | IMD2 |

## 5.11 CA\_n3-n41-n79

### 5.11.1 Common for 1 band UL and 2 bands UL CA

#### 5.11.1.1 Operating bands for CA

Table 5.11.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.11.1.2-1: Supported bandwidths per CA band combination of band n3+n41+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n41A-n79A | CA\_n3A-n41A  CA\_n3A-n79A  CA\_n41A-n79A | 3DL/1UL has already been specified. | | |

#### 5.11.1.3 ∆TIB,c and ∆RIB,c values

Since 3DL/1UL has already been specified, ∆TIB,c and ∆RIB,c values have also been specified.

### 5.11.2 Specific for 2 bands UL CA

#### 5.11.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations such as CA n3-n41, CA\_n3-n79 and n41-n79 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings.

– 2nd and 5th order IMD generated by dual uplink of Band n3 + Band n41 may fall into own Rx of Band n79

– 2nd and 5th order IMD generated by dual uplink of Band n3 + Band n79 may fall into own Rx of Band n41

– 2nd and 5th order IMD generated by dual uplink of Band n41 + Band n79 may fall into own Rx of Band n3

#### 5.11.2.2 REFSENS requirements

Table 5.11.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. For the exception by dual uplink of Band n3 + Band n41, the same exception value in DC\_3A\_n41A-n79A is used. For the exception by dual uplink of Band n3 + Band n79 and Band n41 + Band n79, the same exception values in DC\_3A-41A\_n79A are used.

Table 5.11.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n41-n79 | n3 | 1755 | 5 | 25 | 1850 | 29.4 | FDD | IMD21 |
|  | n41 | 2570 | 10 | 50 | 2570 | N/A | TDD | N/A |
|  | n79 | 4420 | 40 | 216 | 4420 | N/A | TDD | N/A |
|  | n3 | 1770 | 5 | 25 | 1865 | N/A | FDD | N/A |
|  | n41 | 2670 | 10 | 50 | 2670 | 30.2 | TDD | IMD21 |
|  | n79 | 4440 | 40 | 216 | 4440 | N/A | TDD | N/A |
|  | n3 | 1770 | 5 | 25 | 1865 | N/A | FDD | N/A |
|  | n41 | 2670 | 10 | 50 | 2670 | N/A | TDD | N/A |
|  | n79 | 4440 | 40 | 216 | 4440 | 30.8 | TDD | IMD21 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.12 CA\_n29-n70-n71

### 5.12.1 Common for 1 band UL and 2 bands UL CA

#### 5.12.1.1 Operating bands for CA

Table 5.12.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n29-n70-n71 | n29 | N/A | – | N/A | 717 MHz | – | 728 MHz | SDL |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.12.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n29A-n70A-n71A | CA\_n70A-n71A | n29 | 5, 10 | 0 |
| n70 | 5, 10, 15, 201, 251 |
| n71 | 5, 10, 15, 20 |

The following notes are applied to the above tables:

NOTE 1: This UE channel bandwidth is applicable only to downlink.

#### 5.12.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n29-n70-n71,

– The ΔTIB,c values are reused from CA\_n70-n71.

– The ΔRIB,cvalues are reused from CA\_n5-n14-n77 for n29 and n71, and n70 value from n2 three combinations (0.2dB is used when n2 is the only mid band).

These are given in the tables below.

Table 5.12.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n29-n70-n71 | - | 0.3 | 0.6 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.12.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n29-n70-n71 | 0.2 | 0.2 | 0.2 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.12.2 Specific for 2 bands UL CA

#### 5.12.2.1 UE co-existence studies

UE co-existence has already been studied for 2DL/1UL fallback combinations. The impact to the 3rd band Rx is following:

– No IMD generated by dual uplink of Band n70 + Band n71 falls into Band n29 DL.

#### 5.12.2.2 REFSENS requirements

Based on the co-existence studies there is no need to define MSD values.

## 5.13 CA\_n48-n71-n77

### 5.13.1 Common for 1 band UL and 2 bands UL CA

#### 5.13.1.1 Operating bands for CA

Table 5.13.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n48-n71-n77 | n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.13.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n48A-n71A-n77A | CA\_n48A-n71A | n48 | 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 | 0 |
|  | CA\_n71A-n77A | n71 | 5, 10, 15, 20 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.13.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n48-n71-n77, the ΔTIB,c and ΔRIB,c values are reused from CA\_n5-n48-n77 and are given in the tables below.

Table 5.13.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n48-n71-n77 | 0.8 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.13.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n48-n71-n77 | 0.5 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.13.2 Specific for 2 bands UL CA

#### 5.13.2.1 UE co-existence studies

Table 5.13.2.2-1 lists Band n71 + Band n77 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.13.2.2-2 lists Band n48 + Band n71 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.13.2.2-1: Band n48 and Band n71 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 663 | 698 | 3450 | 3600 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2752 | 2937 | 4113 | 4298 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2274 | 2054 | 6202 | 6537 |
| 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) | 4776 | 4996 | 7563 | 7898 |
| 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) | 1611 | 1356 | 9652 | 10137 |
| 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) | 5439 | 5694 | 7563 | 11498 |
| 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) | 5504 | 5874 | 8226 | 8596 |
| 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 | 658 | 13102 | 13737 |
| 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) | 6102 | 6392 | 14463 | 15098 |
| 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) | 5211 | 4806 | 8954 | 9474 |
| 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) | 11676 | 12196 | 8889 | 9294 |

**Table 5.13.2.2-1: Band n71 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 663 | 698 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 | 3537 | 3963 | 4898 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2874 | 1904 | 5902 | 7737 |
| 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) | 4626 | 5596 | 7263 | 9098 |
| 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) | 2211 | 1206 | 9202 | 11937 |
| 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) | 5289 | 6294 | 7263 | 13298 |
| 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) | 5204 | 7074 | 7926 | 9796 |
| 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) | 1548 | 508 | 12502 | 16137 |
| 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) | 5952 | 6992 | 13863 | 17498 |
| 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) | 6411 | 4506 | 8504 | 11274 |
| 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) | 11226 | 13996 | 8589 | 10494 |

Based on the tables above it can be seen that

– n48 + n71 IMD2 may affect Rx frequencies of band n77.

– n71 + n77 IMD2 may affect Rx frequencies of band n48.

#### 5.13.2.2 REFSENS requirements

Looking at further on the IMD impacts, there are no IMD products falling into Rx frequencies of n48 or n77 in the USA. Since in the USA, n77 band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz, IMD products are calculated based on those frequencies. For Canada, this combination does not apply as n48 is US-only.

**Table 5.13.2.3-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n48-n71-n775 | n48 | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
|  | n71 | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
|  | n77 | N/A | N/A | N/A | N/A | N/A | FDD | IMD2 |
|  | n48 | N/A | N/A | N/A | N/A | N/A | FDD | IMD2 |
|  | n71 | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
|  | n77 | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
| NOTE 5: For a UE which supports this band combination only when the Band n77 frequency range restriction defined in NOTE 12 of Table 5.2-1 applies, the MSD test point(s) cannot be verified for the band combination and the test point(s) can be skipped. | | | | | | | | |

## 5.14 CA\_n1-n3-n38

### 5.14.1 Common for 1 band UL and 2 bands UL CA

#### 5.14.1.1 Operating bands for CA

Table 5.14.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n1 | 1920MHz | – | 1980MHz | 2110MHz | – | 2170MHz | FDD |
| n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n38 | 2570MHz | – | 2620MHz | 2570MHz | – | 2620MHz | TDD |

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

Table 5.14.1.2-1: Supported bandwidths per CA band combination of band CA\_n1-n3-n38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n38A | - | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n1A-n3B-n38A | - | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n3 | CA\_n3B\_BCS0 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n1(2A)-n3A-n38A | - | n1 | CA\_n1(2A)\_BCS0 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n1(2A)-n3B-n38A | - | n1 | CA\_n1(2A)\_BCS0 | 0 |
|  |  | n3 | CA\_n3B\_BCS0 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n1A-n3(2A)-n38A | - | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n3 | CA\_n3(2A)\_BCS1 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n1(2A)-n3(2A)-n38A | - | n1 | CA\_n1(2A)\_BCS0 | 0 |
|  |  | n3 | CA\_n3(2A)\_BCS1 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |

#### 5.14.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n3-n38, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.14.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n3-n38 | 0.5 | 0.5 | 0.3 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.14.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n3-n38 | 0.2 | 0.2 | - |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.15 CA\_n1-n7-n38

### 5.15.1 Common for 1 band UL and 2 bands UL CA

#### 5.15.1.1 Operating bands for CA

Table 5.15.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n1 | 1920MHz | – | 1980MHz | 2110MHz | – | 2170MHz | FDD |
| n7 | 2500MHz | – | 2570MHz | 2620MHz | – | 2690MHz | FDD |
| n38 | 2570MHz | – | 2620MHz | 2570MHz | – | 2620MHz | TDD |

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

The following sentence can be introduced into TS 38.101-1 in general clause 5.5A.0 to avoid lots of similar Notes.

*For a band combination which include band n7 and n38 simultaneously, carriers in band n7 and n38 can only be configured as downlink carriers. Power imbalance between downlink carriers on Band n7 and Band n38 is assumed to be within 6dB.*

Table 5.15.1.2-1: Supported bandwidths per CA band combination of band CA\_n1-n7-n38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n7A-n38AX | n1A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n1(2A)-n7A-n38AX | n1A | n1 | CA\_n1(2A)\_BCS0 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| NOTE X: For a band combination which include band n7 and n38 simultaneously, carriers in band n7 and n38 can only be configured as downlink carriers. Power imbalance between downlink carriers on Band n7 and Band n38 is assumed to be within 6dB. | | | | |

#### 5.15.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n7-n38, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.15.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n7-n38 | 0.5 | - | - |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.15.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1-n7-n38 | - | - | - |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.16 CA\_n3-n7-n38

### 5.16.1 Common for 1 band UL and 2 bands UL CA

#### 5.16.1.1 Operating bands for CA

Table 5.16.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n7 | 2500MHz | – | 2570MHz | 2620MHz | – | 2690MHz | FDD |
| n38 | 2570MHz | – | 2620MHz | 2570MHz | – | 2620MHz | TDD |

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

The following sentence can be introduced into TS 38.101-1 in general clause 5.5A.0 to avoid lots of similar Notes.

*For a band combination which include band n7 and n38 simultaneously, carriers in band n7 and n38 can only be configured as downlink carriers. Power imbalance between downlink carriers on Band n7 and Band n38 is assumed to be within 6dB.*

Table 5.16.1.2-1: Supported bandwidths per CA band combination of band CA\_n3-n7-n38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n7A-n38AX | n3A | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n3B-n7A-n38AX | n3A | n3 | CA\_n3B\_BCS0 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n3(2A)-n7A-n38AX | n3A | n3 | CA\_n3(2A)\_BCS1 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 25, 30, 40 |  |
| NOTE X: For a band combination which include band n7 and n38 simultaneously, carriers in band n7 and n38 can only be configured as downlink carriers. Power imbalance between downlink carriers on Band n7 and Band n38 is assumed to be within 6dB. | | | | |

#### 5.16.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n7-n38, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.16.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n7-n38 | 0.5 | - | - |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.16.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n7-n38 | 0 | 0.5 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.17 CA\_n3-n78-n79

### 5.17.1 Common for 1 band UL and 2 bands UL CA

#### 5.17.1.1 Operating bands for CA

Table 5.17.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n3 | 1710MHz | – | 1785MHz | 1805MHz | – | 1880MHz | FDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |
| n79 | 4400MHz | – | 5000MHz | 4400MHz | – | 5000MHz | TDD |

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

Table 5.17.1.2-1: Supported bandwidths per CA band combination of band CA\_n3-n78-n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n78A-n79A | - | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |
| CA\_n3A-n78A-n79C | - | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n79 | CA\_n79C\_BCS0 |  |
| CA\_n3B-n78A-n79A | - | n3 | CA\_n3B\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |
| CA\_n3B-n78A-n79C | - | n3 | CA\_n3B\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n79 | CA\_n79C\_BCS0 |  |
| CA\_n3(2A)-n78A-n79A | - | n3 | CA\_n3(2A)\_BCS1 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |
| CA\_n3(2A)-n78A-n79C | - | n3 | CA\_n3(2A)\_BCS1 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n79 | CA\_n79C\_BCS0 |  |
|  | | | | |

#### 5.17.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n78-n79, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.17.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n78-n79 | 0.6 | 0.8 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.17.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n78-n79 | 0.2 | 0.5 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.18 CA\_n5-n7-n77

### 5.18.1 Common for 1 band UL and 2 bands UL CA

#### 5.18.1.1 Operating bands for CA

Table 5.18.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5A-n7A-n77A | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
|  | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
|  | n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.x.1.2-1: Supported bandwidths per CA band combination of band n5+n7+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n7A-n77A | CA\_n5A-n7A CA\_n5-n77A CA\_n7-n77A | n5 | See n5A channel bandwidths in Table 5.3.5-1 | 0 |
|  |  | n7 | See n7A channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | See n77A channel bandwidths in Table 5.3.5-1 |  |

#### 5.18.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5-n7-n77, the ΔTIB,c and ΔRIB,c values are reused from DC\_5-7\_n77 and are given in the tables below.

Table 5.18.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n7-n77 | 0.6 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.18.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n7-n77 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.18.2 Specific for 2 bands UL CA

#### 5.18.2.1 UE co-existence studies

UL n5-n7 gives IMD2, IMD3 and IMD4 into DL n77.

UL n5-n77 gives IMD2 into DL n7.

UL n7-n77 gives IMD2 and IMD3 into DL n5.

#### 5.18.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from DC\_5-7\_n77 are reused, where possible, while n5+n7 into n77 is added in same range of MSD as the other two MSD values.

Table 5.18.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n5-n7-n77 | n5 | 844 | 5 | 25 | 889 | N/A | FDD | N/A |
|  | n7 | 2525 | 5 | 25 | 2645 | 30.1 | FDD | IMD2 |
|  | n77 | 3489 | 10 | 50 | 3489 | N/A | TDD | N/A |
|  | n5 | 834 | 5 | 25 | 879 | 30.2 | FDD | IMD21 |
|  | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
|  | n77 | 3429 | 10 | 50 | 3429 | N/A | TDD | N/A |
|  | n5 | 827 | 5 | 25 | 852 | N/A | FDD | N/A |
|  | n7 | 2503 | 5 | 25 | 2623 | N/A | FDD | N/A |
|  | n77 | 3330 | 10 | 50 | 3330 | 30.2 | TDD | IMD21 |
| NOTE 1: This band is subject to IMD3 also which MSD is not specified | | | | | | | | |

## 5.19 CA\_n7-n71-n77

### 5.19.1 Common for 1 band UL and 2 bands UL CA

#### 5.19.1.1 Operating bands for CA

Table 5.19.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7A-n71A-n77A | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
|  | n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
|  | n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.19.1.2-1: Supported bandwidths per CA band combination of band n7+n71+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n71A-n77A | CA\_n7A-n71A CA\_n7A-n77A CA\_n71-n77A | n7 | See n7A channel bandwidths in Table 5.3.5-1 | 0 |
|  |  | n71 | See n71A channel bandwidths in Table 5.3.5-1 |  |
|  |  | n77 | See n77A channel bandwidths in Table 5.3.5-1 |  |

#### 5.19.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n71-n77, the ΔTIB,c and ΔRIB,c values are reused from DC\_7\_n71-n78 and are given in the tables below.

Table 5.19.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7-n71-n77 | 0.3 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.19.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7-n71-n77 | - | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.19.2 Specific for 2 bands UL CA

#### 5.19.2.1 UE co-existence studies

UL n7-n71 gives IMD3 and IMD4 into DL n77.

UL n7-n77 does not affect DL n71.

UL n71-n77 gives IMD2 into DL n7.

#### 5.19.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from DC\_7-71\_n78 are reused, for IMD2 into n7, while n7+n71 into n77 is added in same range of MSD as DC\_2\_n5-n77, since this is the same product that hits n77 (2 times lowband + midband = highband).

Table 5.19.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n71-n77 | n7 | 2505 | 5 | 25 | 2625 | N/A | FDD | N/A |
|  | n71 | 666 | 5 | 25 | 620 | N/A | FDD | N/A |
|  | n77 | 3837 | 10 | 50 | 3837 | 16.0 | TDD | IMD3 |
|  | n7 | 2550 | 5 | 25 | 2670 | 29.6 | FDD | IMD2 |
|  | n71 | 680 | 5 | 25 | 634 | N/A | FDD | N/A |
|  | n77 | 3350 | 10 | 50 | 3350 | N/A | TDD | N/A |

## 5.20 CA\_n48-n70-n77

### 5.20.1 Common for 1 band UL and 2 bands UL CA

#### 5.20.1.1 Operating bands for CA

Table 5.20.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n48-n70-n77 | n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.20.1.2-1: Supported bandwidths per CA band combination of band n48+n70+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n48A-n70A-n77A | CA\_n48A-n70A | n48 | 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100 | 0 |
|  | CA\_n70A-n77A | n70 | 5, 10, 15, 20, 25 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.20.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n48-n70-n77, the ΔTIB,c and ΔRIB,c values are reused from CA\_n2-n48-n77 and are given in the tables below.

Table 5.20.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n48-n70-n77 | 0.8 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.20.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n48-n70-n77 | 0.5 | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.20.2 Specific for 2 bands UL CA

#### 5.20.2.1 UE co-existence studies

Table 5.20.2.2-1 lists Band n48 + Band n70 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.20.2.2-2 lists Band n70 + Band n77 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.20.2.2-1: Band n48 and Band n70 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 1695 | 1710 | 3550 | 3700 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1840 | 2005 | 5245 | 5410 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 310 | 130 | 5390 | 5705 |
| 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) | 6940 | 7120 | 8795 | 9110 |
| 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) | 1385 | 1580 | 8940 | 9405 |
| 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) | 8635 | 8830 | 8795 | 12810 |
| 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) | 3680 | 4010 | 10490 | 10820 |
| 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) | 3080 | 3290 | 12490 | 13105 |
| 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) | 10330 | 10540 | 15895 | 16510 |
| 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) | 2315 | 1970 | 7230 | 7710 |
| 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) | 14040 | 14520 | 12185 | 12530 |

**Table 5.20.2.2-2: Band n70 and Band n77 UL (3450-3550 MHz) IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 1695 | 1710 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1740 | 1855 | 4114 | 5049 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 160 | 30 | 5751 | 7586 |
| 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) | 6840 | 6970 | 7414 | 9249 |
| 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) | 1535 | 1680 | 9051 | 11786 |
| 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) | 8535 | 8680 | 7414 | 13449 |
| 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) | 3480 | 3710 | 8228 | 10098 |
| 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) | 3230 | 3390 | 12351 | 15986 |
| 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) | 10230 | 10390 | 14014 | 17649 |
| 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) | 2015 | 1770 | 8202 | 10972 |
| 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) | 13740 | 14070 | 9042 | 10947 |

Based on the tables above it can be seen that

n48 + n70 IMD4 may affect Rx frequencies of band n77.

N70 + n77 IMD4 and IMD5 may affect Rx frequencies of band n48.

#### 5.20.2.2 REFSENS requirements

IMD frequencies shown in the previous section do not apply as there is no simultaneous Tx/Rx operation between NR n48 and n77 carriers. Thus, there is no additional co-existence issue is identified.

## 5.21 CA\_n66-n70-n77

### 5.21.1 Common for 1 band UL and 2 bands UL CA

#### 5.21.1.1 Operating bands for CA

Table 5.21.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n66-n70-n77 | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.21.1.2-1: Supported bandwidths per CA band combination of band n66+n70+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n66A-n70A-n77A | CA\_n66A-n77A | n66 | 5, 10, 15, 20, 25, 30, 35, 40 | 0 |
|  | CA\_n70A-n77A | n70 | 5, 10, 15, 20, 25 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.21.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n66-n70-n77, the ΔTIB,c and ΔRIB,c values are reused from CA\_n2-n66-n77 and are given in the tables below.

Table 5.21.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n66-n70-n77 | 0.6 | 0.6 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.21.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n66-n70-n77 | 0.2 | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.21.2 Specific for 2 bands UL CA

#### 5.21.2.1 UE co-existence studies

Table 5.21.2.2-1lists Band n66 + Band n77 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.21.2.2-2 lists Band n70 + Band n77 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.21.2.2-1: Band n70 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 663 | 698 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 | 3537 | 3963 | 4898 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2874 | 1904 | 5902 | 7737 |
| 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) | 4626 | 5596 | 7263 | 9098 |
| 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) | 2211 | 1206 | 9202 | 11937 |
| 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) | 5289 | 6294 | 7263 | 13298 |
| 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) | 5204 | 7074 | 7926 | 9796 |
| 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) | 1548 | 508 | 12502 | 16137 |
| 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) | 5952 | 6992 | 13863 | 17498 |
| 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) | 6411 | 4506 | 8504 | 11274 |
| 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) | 11226 | 13996 | 8589 | 10494 |

**Table 5.21.2.2-2: Band n70 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 1695 | 1710 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1590 | 2505 | 4995 | 5910 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 810 | 120 | 4890 | 6705 |
| 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) | 6690 | 7620 | 8295 | 10110 |
| 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) | 885 | 1830 | 8190 | 10905 |
| 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) | 8385 | 9330 | 8295 | 14310 |
| 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) | 3180 | 5010 | 9990 | 11820 |
| 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) | 2580 | 3540 | 11490 | 15105 |
| 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) | 10080 | 11040 | 14895 | 18510 |
| 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) | 3315 | 1470 | 6480 | 9210 |
| 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) | 13290 | 16020 | 11685 | 13530 |

Based on the tables above it can be seen that

n66 + n77 IMD2, IMD4 or IMD5 may affect Rx frequencies of band n70.

N70 + n77 IMD2 or IMD5 may affect Rx frequencies of band n66.

#### 5.21.2.2 REFSENS requirements

Looking further on the IMD impacts, in both cases, only IMD2 products may fall into Rx frequencies of n66 or n70 in the USA. Since in the USA, n77 band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz, IMD products are calculated based on those frequencies.

MSD values are reused from CA\_n2A-n66A-n77A.

**Table 5.21.2.3-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n66-n70-n77 | n66 | 1757.5 | 5 | 25 | 2157.5 | N/A | FDD | N/A |
|  | n70 | 1707.5 | 5 | 25 | 2007.5 | 32.1 | FDD | IMD2x,y |
|  | n77 | 3765 | 10 | 50 | 3765 | N/A | TDD | N/A |
|  | n66 | 1762.5 | 5 | 25 | 2162.5 | 29.2 | FDD | IMD2y |
|  | n70 | 1702.5 | 5 | 25 | 2002.5 | N/A | FDD | N/A |
|  | n77 | 3865 | 10 | 50 | 3865 | N/A | TDD | N/A |
| NOTE x: This band is subject to IMD4 also which MSD is not specified.  NOTE y: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.22 CA\_n70-n71-n77

### 5.22.1 Common for 1 band UL and 2 bands UL CA

#### 5.22.1.1 Operating bands for CA

Table 5.22.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n70-n71-n77 | n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.22.1.2-1: Supported bandwidths per CA band combination of band n70+n71+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n70A-n71A-n77A | CA\_n70A-n71A  CA\_n70A-n77A | n70 | 5, 10, 15, 20, 25 | 0 |
|  | CA\_n71A-n77A | n71 | 5, 10, 15, 20 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.22.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n70-n71-n77, the ΔTIB,c and ΔRIB,c values are reused from CA\_n2-n12-n77 and are given in the tables below.

Table 5.22.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n70-n71-n77 | 0.6 | 0.3 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.22.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n70-n71-n77 | 0.2 | 0.2 | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.22.2 Specific for 2 bands UL CA

#### 5.22.2.1 UE co-existence studies

Table 5.22.2.2-1 lists Band n70 + Band n71 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.22.2.2-2 lists Band n70 + Band n77 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.22.2.2-3 lists Band n71 + Band n77 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.22.2.2-1: Band n70 and Band n71 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 663 | 698 | 1695 | 1710 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 997 | 1047 | 2358 | 2408 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 384 | 299 | 2692 | 2757 |
| 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) | 3021 | 3106 | 4053 | 4118 |
| 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) | 279 | 399 | 4387 | 4467 |
| 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) | 3684 | 3804 | 4053 | 5828 |
| 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) | 1994 | 2094 | 4716 | 4816 |
| 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) | 942 | 1097 | 6082 | 6177 |
| 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) | 4347 | 4502 | 7443 | 7538 |
| 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) | 1431 | 1296 | 3689 | 3804 |
| 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) | 6411 | 6526 | 5379 | 5514 |

**Table 5.22.2.2-2: Band n70 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 1695 | 1710 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1740 | 1855 | 4114 | 5049 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 160 | 30 | 5751 | 7586 |
| 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) | 6840 | 6970 | 7414 | 9249 |
| 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) | 1535 | 1680 | 9051 | 11786 |
| 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) | 8535 | 8680 | 7414 | 13449 |
| 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) | 3480 | 3710 | 8228 | 10098 |
| 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) | 3230 | 3390 | 12351 | 15986 |
| 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) | 10230 | 10390 | 14014 | 17649 |
| 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) | 2015 | 1770 | 8202 | 10972 |
| 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) | 13740 | 14070 | 9042 | 10947 |

**Table 5.22.2.2-3: Band n71 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **f1\_low** | **f1\_high** | **f2\_low** | **f2\_high** |
| UL frequencies (MHz) | 663 | 698 | 3300 | 4200 |
| 2nd order IMD products | |fy\_high – fx\_low| | |fy\_low – fx\_high| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2602 | 3537 | 3963 | 4898 |
| 3rd order IMD products | |fy\_high – 2\*fx\_low| | |fy\_low – 2\*fx\_high| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2874 | 1904 | 5902 | 7737 |
| 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) | 4626 | 5596 | 7263 | 9098 |
| 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) | 2211 | 1206 | 9202 | 11937 |
| 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) | 5289 | 6294 | 7263 | 13298 |
| 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) | 5204 | 7074 | 7926 | 9796 |
| 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) | 1548 | 508 | 12502 | 16137 |
| 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) | 5952 | 6992 | 13863 | 17498 |
| 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) | 6411 | 4506 | 8504 | 11274 |
| 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) | 11226 | 13996 | 8589 | 10494 |

Based on the tables above it can be seen that

n70 + n71 IMD3, IMD4, and IMD5 may affect Rx frequencies of band n77。

N71 + n77 IMD3 and IMD4 may affect Rx frequencies of band n70.

#### 5.22.2.2 REFSENS requirements

Looking further on the IMD impacts, only IMD4 and IMD5 products of n70+n71 may fall into Rx frequencies of n77 in the USA. Other MSD test points are not applicable. Since in the USA, n77 band is restricted to 3450 – 3550 MHz and 3700 – 3980 MHz, IMD products are calculated based on those frequencies.

MSD values are reused from CA\_n5A-n66A-n77A.

**Table 5.22.2.3-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n70-n71-n775 | n70 | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
|  | n71 | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
|  | n77 | N/A | N/A | N/A | N/A | N/A | TDD | IMD35 |
|  | n70 | 1702.5 | 5 | 25 | 2002.5 | N/A | FDD | N/A |
|  | n71 | 680.5 | 5 | 25 | 834.5 | N/A | FDD | N/A |
|  | n77 | 3745 | 10 | 50 | 3745 | 8.2 | TDD | IMD4 |
|  | n70 | 1702.5 | 5 | 25 | 2002.5 | N/A | FDD | N/A |
|  | n71 | 680.5 | 5 | 25 | 834.5 | N/A | FDD | N/A |
|  | n77 | 3745 | 10 | 50 | 3745 | 3.3 | TDD | IMD5 |
|  | n70 | N/A | N/A | N/A | N/A | N/A | FDD | IMD35 |
|  | n71 | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
|  | n77 | N/A | N/A | N/A | N/A | N/A | TDD | N/A |
|  | n70 | N/A | N/A | N/A | N/A | N/A | FDD | IMD45 |
|  | n71 | N/A | N/A | N/A | N/A | N/A | FDD | N/A |
|  | n77 | N/A | N/A | N/A | N/A | N/A | TDD | N/A |
| NOTE 5: For a UE which supports this band combination only when the Band n77 frequency range restriction defined in NOTE 12 of Table 5.2-1 applies, the MSD test point(s) cannot be verified for the band combination and the test point(s) can be skipped. | | | | | | | | |

## 5.23 CA\_n1-n3-n38

### 5.23.1 Common for 1 band UL and 2 bands UL CA

#### 5.23.1.1 Operating bands for CA

Table 5.23.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n38 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n38 | 2570MHz |  | 2620MHz | 2570MHz |  | 2620MHz | TDD |

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

Table 5.23.1.2-1: Supported bandwidths per CA band combination of band n1+n3+n38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n38A | - | n1 | 5, 10, 15, 20, 30, 40, 50 | 0 |
|  |  | n3 | 5, 10, 15, 20, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 30, 40 |  |

#### 5.23.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n3-n38, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n3-n7 and are given in the tables below.

Table 5.23.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n3-n38 | 0.6 | 0.6 | 0.6 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.23.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n3-n38 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.24 CA\_n1-n7-n38

### 5.24.1 Common for 1 band UL and 2 bands UL CA

#### 5.24.1.1 Operating bands for CA

Table 5.24.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n7-n38 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n38 | 2570MHz |  | 2620MHz | 2570MHz |  | 2620MHz | TDD |

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

Table 5.24.1.2-1: Supported bandwidths per CA band combination of band n1+n7+n38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n7A-n38A | - | n1 | 5, 10, 15, 20, 30, 40, 50 | 0 |
|  |  | n7 | 5, 10, 15, 20, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 30, 40 |  |

#### 5.24.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n7-n38, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n7 and are given in the tables below.

Table 5.24.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n7-n38 | 0.5 | 0.6 | 0.6 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.24.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n7-n38 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.25 CA\_n3-n7-n38

### 5.25.1 Common for 1 band UL and 2 bands UL CA

#### 5.25.1.1 Operating bands for CA

Table 5.x.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n7-n38 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n38 | 2570MHz |  | 2620MHz | 2570MHz |  | 2620MHz | TDD |

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

Table 5.x.1.2-1: Supported bandwidths per CA band combination of band n3+n7+n38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n7A-n38A | - | n3 | 5, 10, 15, 20, 30, 40, 50 | 0 |
|  |  | n7 | 5, 10, 15, 20, 30, 40, 50 |  |
|  |  | n38 | 5, 10, 15, 20, 30, 40 |  |

#### 5.25.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n7-n38, the ΔTIB,c and ΔRIB,c values are reused from DC\_3\_n7 and are given in the tables below.

Table 5.25.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n7-n38 | 0.5 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.25.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n7-n38 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.26 CA\_n3-n28-n38

### 5.26.1 Common for 1 band UL and 2 bands UL CA

#### 5.26.1.1 Operating bands for CA

Table 5.26.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n28-n38 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n38 | 2570MHz |  | 2620MHz | 2570MHz |  | 2620MHz | TDD |

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

Table 5.26.1.2-1: Supported bandwidths per CA band combination of band n3+n28+n38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n28A-n38A | - | n3 | 5, 10, 15, 20, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n38 | 5, 10, 15, 20, 30, 40 |  |

#### 5.26.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n28-n38, the ΔTIB,c and ΔRIB,c values are reused from CA\_n3-n7-n28 and are given in the tables below.

Table 5.26.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n28-n38 | 0.5 | 0.5 | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.26.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n28-n38 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.27 CA\_n7-n28-n38

### 5.27.1 Common for 1 band UL and 2 bands UL CA

#### 5.27.1.1 Operating bands for CA

Table 5.27.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n28-n38 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n38 | 2570MHz |  | 2620MHz | 2570MHz |  | 2620MHz | TDD |

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

Table 5.27.1.2-1: Supported bandwidths per CA band combination of band n7+n28+n38

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n28A-n38Ax | n28 | n7 | 5, 10, 15, 20, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n38 | 5, 10, 15, 20, 30, 40 |  |
| NOTE x: UL carrier shall be supported in Band n28 only. Power imbalance between downlink carriers on Band 7 and Band 38 is assumed to be within 6dB. | | | | |

#### 5.27.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n28-n38, the ΔTIB,c and ΔRIB,c values are reused from CA\_n7-n28 and are given in the tables below.

Table 5.27.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7-n28-n38 | 0.3 | 0.3 | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.27.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7-n28-n38 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

## 5.28 CA\_n39-n41-n79

### 5.28.1 Common for 1 band UL and 2 bands UL CA

#### 5.28.1.1 Operating bands for CA

Table 5.28.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n39 | 1880 MHz | – | 1920 MHz | 1880 MHz | – | 1920 MHz | TDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.28.1.2-1: Supported bandwidths per CA band combination of band n39+n41+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n39A-n41A-n79A | CA\_n39A-n41A  CA\_n39A-n79A  CA\_n41A-n79A | n39 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n41 | 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |
|  |  | n39 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n41 | 10, 15, 20, 40, 50, 60 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |

#### 5.28.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n39A-n41A-n79, the ΔTIB,c and ΔRIB,c values have already been included in the TS38.101-1.

### 5.28.2 Specific for 2 bands UL CA

#### 5.28.2.1 UE co-existence studies

Due to synchronization between band n39 and n41, so there are no IMD issues for n41caused by n39-n79, or n39 caused by n41-n79.

However, asynchronization between band n39 and n79 or n41 and n79, in terms of the co-existence studies of CA\_n39-n41, it can be observed:

IMD2 caused by 2UL n39+n41 may fall into the its own band n79 Rx (4376MHz~4610MHz)

#### 5.28.2.2 REFSENS requirements

In terms of the co-existence studies, the impacted n79 Rx frequency range is from 4376MHz~4610MHz caused by 2UL n39 and n41. However, in China, the n79 frequency range is restricted to 4800-5000MHz. Therefore, considering this frequency range, n79 will not be impacted by IMD2 caused by 2UL n39 and n41. In the other words, there is no need to define the IMD2 MSD for CA n39A-n41A-n79. The MSD requirement are defined in table 5.28.2.2-1:

Table 5.28.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n39-n41-n79 | n39 | N/A | N/A | N/A | N/A | N/A | TDD | N/A |
|  | n41 | N/A | N/A | N/A | N/A | N/A | TDD | N/A |
|  | n79 | N/A | N/A | N/A | N/A | N/A | TDD | IMD2x |
| NOTE x: There is no IMD2 product in band n79 downlink for n79 operating in 4800 – 5000 MHz frequency range. | | | | | | | | |

## 5.29 CA\_n1-n3-n40

### 5.29.1 Common for 1 band UL and 2 bands UL CA

#### 5.29.1.1 Operating bands for CA

Table 5.29.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n40 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |

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

Table 5.29.1.2-1: Supported bandwidths per CA band combination of band n1+n3+n40

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n40A | CA\_n1A-n3A  CA\_n1A-n40A  CA\_n3A-n40A | n1 | 5, 10, 15, 20, 30, 40, 45, 50 | 0 |
|  |  | n3 | 5, 10, 15, 20, 30, 35, 40, 45, 50 |  |
|  |  | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.29.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n3-n40, the ΔTIB,c and ΔRIB,c values are reused from DC\_1-3\_n40 and are given in the tables below.

Table 5.29.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n3-n40 | 0.5 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.29.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n3-n40 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.29.2 Specific for 2 bands UL CA

#### 5.29.2.1 UE co-existence studies

UL n1-n3 gives IMD5 into DL n40.

UL n1-n40 does not affect DL n3.

UL n3-n40 does not affect DL n1.

#### 5.29.2.2 REFSENS requirements

Based on the co-existence studies there is a need to define MSD values. MSD value from CA\_1-3-40 is reused.

Table 5.29.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n3-n40 | n1 | 1950 | 5 | 25 | 2140 | N/A | FDD | N/A |
|  | n3 | 1735 | 5 | 25 | 1830 | N/A | FDD | N/A |
|  | n40 | 2380 | 5 | 25 | 2380 | 8.0 | TDD | IMD5 |

## 5.30 CA\_n1-n40-n77

### 5.30.1 Common for 1 band UL and 2 bands UL CA

#### 5.30.1.1 Operating bands for CA

Table 5.30.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n40-n77 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.30.1.2-1: Supported bandwidths per CA band combination of band n1+n40+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n40A-n77A | CA\_n1A-n40A  CA\_n1A-n77A  CA\_n40A-n77A | n1 | 5, 10, 15, 20, 30, 40, 45, 50 | 0 |
|  |  | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n1A-n40A-n77(2A) | CA\_n1A-n40A  CA\_n1A-n77A  CA\_n40A-n77A | n1 | 5, 10, 15, 20, 30, 40, 45, 50 | 0 |
|  |  | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n77 | CA\_n77(2A)\_BCS1 |  |

#### 5.30.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n40-n77, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n40-n78 and are given in the tables below.

Table 5.x.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n40-n77 | 0.3 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.x.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n40-n77 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.30.2 Specific for 2 bands UL CA

#### 5.30.2.1 UE co-existence studies

UL n1-n40 gives IMD4 and IMD5 into DL n77.

UL n1-n77 gives IMD4 and IMD5 into DL n40.

UL n40-n77 gives IMD4 into DL n1.

#### 5.30.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_n1-n40-n78 are reused.

Table 5.30.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n40-n77 | n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
|  | n77 | 3480 | 10 | 50 | 3480 | 9.8 | TDD | IMD41 |
|  | n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n40 | 2340 | 5 | 25 | 2340 | 10.6 | TDD | IMD41 |
|  | n77 | 3450 | 10 | 50 | 3450 | N/A | TDD | N/A |
|  | n1 | 1950 | 5 | 25 | 2140 | 9.1 | FDD | IMD4 |
|  | n40 | 2380 | 5 | 25 | 2380 | N/A | TDD | N/A |
|  | n77 | 3450 | 10 | 50 | 3450 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.31 CA\_n3-n40-n77

### 5.31.1 Common for 1 band UL and 2 bands UL CA

#### 5.31.1.1 Operating bands for CA

Table 5.31.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n40-n77 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.31.1.2-1: Supported bandwidths per CA band combination of band n3+n40+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n40A-n77A | CA\_n3A-n40A  CA\_n3A-n77A  CA\_n40A-n77A | n3 | 5, 10, 15, 20, 30, 35, 40, 45, 50 | 0 |
|  |  | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n3A-n40A-n77(2A) | CA\_n3A-n40A  CA\_n3A-n77A  CA\_n40A-n77A | n3 | 5, 10, 15, 20, 30, 35, 40, 45, 50 | 0 |
|  |  | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n77 | CA\_n77(2A)\_BCS1 |  |

#### 5.31.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n40-n77, the ΔTIB,c and ΔRIB,c values are reused from DC\_3\_n40-n78 and are given in the tables below.

Table 5.31.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n40-n77 | 0.6 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.31.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n40-n77 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.31.2 Specific for 2 bands UL CA

#### 5.31.2.1 UE co-existence studies

UL n3-n40 gives IMD2 and IMD5 into DL n77.

UL n3-n77 gives IMD2 and IMD5 into DL n40.

UL n40-n77 gives IMD2 and IMD4 into DL n3.

#### 5.31.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_n1-n41-n79 are reused.

Table 5.31.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n40-n77 | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n40 | 2320 | 5 | 25 | 2320 | N/A | TDD | N/A |
|  | n77 | 4050 | 10 | 50 | 4050 | 19.0 | TDD | IMD21 |
|  | n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
|  | n40 | 2310 | 5 | 25 | 2310 | 29.4 | TDD | IMD21 |
|  | n77 | 4030 | 10 | 50 | 4030 | N/A | TDD | N/A |
|  | n3 | 1725 | 5 | 25 | 1820 | 29.9 | FDD | IMD22 |
|  | n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
|  | n77 | 4130 | 10 | 50 | 4130 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.32 CA\_n28-n40-n77

### 5.32.1 Common for 1 band UL and 2 bands UL CA

#### 5.32.1.1 Operating bands for CA

Table 5.32.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n40-n77 | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.32.1.2-1: Supported bandwidths per CA band combination of band n28+n40+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n28A-n40A-n77A | CA\_n28A-n40A  CA\_n28A-n77A  CA\_n40A-n77A | n28 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n28A-n40A-n77(2A) | CA\_n28A-n40A  CA\_n28A-n77A  CA\_n40A-n77A | n28 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n77 | CA\_n77(2A)\_BCS1 |  |

#### 5.32.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n28-n40-n77, the ΔTIB,c and ΔRIB,c values are reused from CA\_n28-n40-n78 and are given in the tables below.

Table 5.32.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n28-n40-n77 | 0.5 | 0.3 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.32.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n28-n40-n77 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.32.2 Specific for 2 bands UL CA

#### 5.32.2.1 UE co-existence studies

UL n28-n40 gives IMD3 and IMD4 into DL n77.

UL n28-n77 gives IMD3 into DL n40.

UL n40-n77 gives IMD3 and IMD5 into DL n28.

#### 5.32.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_n28-n40-n78 are reused.

Table 5.32.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n28-n40-n77 | n28 | 745.5 | 5 | 25 | 800.5 | 11 | FDD | IMD31 |
|  | n40 | 2302.5 | 5 | 25 | 2302.5 | N/A | TDD | N/A |
|  | n77 | 3795 | 10 | 50 | 3795 | N/A | TDD | N/A |
|  | n28 | 708 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
|  | n77 | 3736 | 10 | 50 | 3736 | 16.0 | TDD | IMD32 |
|  | n28 | 708 | 5 | 25 | 763 | N/A | FDD | N/A |
|  | n40 | 2134 | 5 | 25 | 2134 | 15.7 | TDD | IMD3 |
|  | n77 | 3550 | 10 | 50 | 3550 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.33 CA\_n1-n3-n8

### 5.33.1 Common for 1 band UL and 2 bands UL CA

#### 5.33.1.1 Operating bands for CA

Table 5.33.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n1 | 1920 MHz | – | 1980MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |

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

Table 5.33.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n8A | **CA\_n1A-n3A**  **CA\_n1A-n8A**  **CA\_n3A-n8A** | n1 | 5, 10, 15, 20 | 0 |
|  |  | n3 | 5, 10, 15, 20, 25, 30 |  |
|  |  | n8 | 5, 10, 15, 20 |  |

#### 5.33.1.3 ∆TIB,c and ∆RIB,c values

Note that CA\_n1A-n3A-n8A 1UL/3DL CA had been introduced in Rel.17 38.101-1, related sections for 1UL/3DL CA can be found in TR 38.717-03-01 section 6.103.

### 5.33.2 Specific for 2 bands UL CA

#### 5.33.2.1 UE co-existence studies

Since the UE co-existence tables have already been provided in 2DL/2UL fallback combinations, CA\_n1-n3, CA\_n1-n8, CA\_n3-n8, which are studied in section 6.43, 6.38, 6.19 of TR 38.716-02-00, here we list the own Rx impact on the 3rd band below.

- No IMD generated by dual uplink of Band n1 + Band n3 will fall into own Rx of Band n8.

- No IMD generated by dual uplink of Band n1 + Band n8 will fall into own Rx of Band n3.

- No IMD generated by dual uplink of Band n3 + Band n8 will fall into own Rx of Band n1.

#### 5.33.2.2 REFSENS requirements

No additional MSD requirement for IMD is expected.

## 5.34 CA\_n3-n67-n78

### 5.34.1 Common for 1 band UL and 2 bands UL CA

#### 5.34.1.1 Operating bands for CA

Table 5.34.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n67-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n67 |  | N/A |  | 783 MHz | – | 758 MHz | SDL |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.34.1.2-1: Supported bandwidths per CA band combination of band n3-n67-n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n67A-n78A | CA\_n3A-n78A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n67 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n3A-n67A-n78(2A) | CA\_n78(2A)  CA\_n3A-n78A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n67 | 5, 10, 15, 20 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |

#### 5.34.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n67-n78, the ΔTIB,c and ΔRIB,c values are reused from CA\_n3-n28-n78 and are given in the tables below.

Table 5.34.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n67-n78 | 0.5 | - | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.34.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n67-n78 | - | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.34.2 Specific for 2 bands UL CA

#### 5.34.2.1 UE co-existence studies

Table 5.x.2.1-1 lists up to 7th order IMD from UL CA\_n78(2A) UE-to-UE coexistence analysis

**Table 5.34.2.1-1: CA\_n78(2A) IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H | fU2H | fU3H |
| Frequency | 3300 | 3320 | 3780 | 3800 | 3780 | 3320 |
| 2nd | I fU1L-fU2L I | I fU1L-fU3L I | fU1L + fU2L | fU1H+fU2H |  |  |
| Ranges | 20 | 480 | 6620 | 7580 |  |  |
| 3rd | 2\*fU1L-fU3L | 2\*fU1H-fU3H | 2\*fU1L + fU2L | 2\*fU1H + fU2H |  |  |
| Ranges | 2820 | 4280 | 9920 | 11380 |  |  |
| 4th | I 2\*fU1L – 2\*fU2L I | I 2\*fU1H – 2\*fU3H I | 3\*fU1L – fU3L | 3\*fU1H – fU3H | 3\*fU1L + fU2L | 3\*fU1H + fU2H |
| Ranges | 40 | 960 | 6120 | 8080 | 13220 | 15180 |
| 5th | I 3\*fUL1-2\*fU3L I | I 3\*fUH1-2\*fU3H I | 4\*fUL1-fU3L | 4\*fUH1-fU3H | 4\*fUL1+fU2L | 4\*fUH1+fU2H |
| Ranges | 2340 | 4760 | 9420 | 11880 | 16520 | 18980 |
| 6th | I 3\*fUL1-3\*fU2L I | I 3\*fUH1-3\*fU3H I | 4\*fUL1-2\*fU3L | 4\*fUH1-2\*fU3H | 5\*fUL1-fU3L | 5\*fUH1-fU3H |
| Ranges | 60 | 1440 | 5640 | 8560 | 12720 | 15680 |
| 7th | I 4\*fUL1-3\*fU3L I | I 4\*fUH1-3\*fU3H I | 5\*fUL1-2\*fU3L | 5\*fUH1-2\*fU3H | 6\*fUL1-fU3L | 6\*fUH1-fU3H |
| Ranges | 1860 | 5240 | 8940 | 12360 | 16020 | 19480 |

As can be seen in the co-existence analysis above there are IMD4 and IMD6 products from CA\_n78(2A) affecting band n67 DL and IMD7 product from CA\_n78(2A) affecting band n3 DL.

#### 5.34.2.2 REFSENS requirements

The MSD value due to IMD4 and 6 is defined in CA\_n67-n78(2A)

Table 5.x.2.2-1 lists the MSD required due to IMD7 for the dual uplink configuration.

**Table 5.34.2.2-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Operating band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |
| CA\_n3-n67-n78 | n3 | N/A | 5 | 25 | 1877.5 | 2.2 | FDD | IMD7 |
|  | n67 | N/A | 5 | N/A | N/A | N/A | SDL | N/A |
| n7812 | 3305 | 10 | 1 RBSTART=25 | 3305 | N/A | TDD | N/A |
|  |  | 3780 | 10 | 1 RBSTART=25 | 3780 |  |  |  |
| NOTE 12: This band supports intra-band non-contiguous uplink configuration | | | | | | | | |

## 5.35 CA\_n3-n20-n28

### 5.35.1 Common for 1 band UL and 2 bands UL CA

#### 5.35.1.1 Operating bands for CA

Table 5.35.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n20-n28 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| n281 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| NOTE1: For this band combination the band n28 spectrum is restricted to the lower 30 MHz of the band | | | | | | | | |

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

Table 5.35.1.2-1: Supported bandwidths per CA band combination of band n3-n20-n28

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n20A-n28A | CA\_n3A-n20A  CA\_n3A-n28A  CA\_n20A-n28A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n20 | 5, 10, 15, 20 |  |
|  |  | n28 | 5, 10, 15, 20, 30 |  |

#### 5.35.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n20-n28, the ΔTIB,c and ΔRIB,c values are reused from DC\_3-20\_n28 and are given in the tables below.

Table 5.35.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n20-n28 | 0.3 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.35.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n20-n28 | - | 0.1 | 0.1 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.35.2 Specific for 2 bands UL CA

#### 5.35.2.1 UE co-existence studies

UL n3-n20 gives IMD4 into DL n28.

UL n20-n28 gives IMD4 into DL n3.

#### 5.35.2.2 REFSENS requirements

Based on the co-existence studies there is a need to define MSD values. MSD value of n3 from DC\_3-20-n28 is reused. MSD value of n28 from CA\_n3-n20-n67 is reused.

Table 5.35.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n20-n28 | n3 | 1733 | 5 | 25 | 1828 | 9.4 | FDD | IMD4 |
|  | n20 | 852 | 5 | 25 | 811 | N/A | FDD | N/A |
|  | n28 | 728 | 5 | 25 | 783 | N/A | FDD | N/A |
|  | n3 | 1748 | 5 | 25 | 1843 | N/A | FDD | N/A |
|  | n20 | 847 | 5 | 25 | 806 | N/A | FDD | N/A |
|  | n28 | 738 | 5 | 25 | 793 | 9.4 | FDD | IMD4 |

## 5.36 CA\_n3-n7-n79

### 5.36.1 Common for 1 band UL and 2 bands UL CA

#### 5.36.1.1 Operating bands for CA

**Table 5.36.1.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n7-n79 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

**Table 5.36.1.2-1: Supported channel bandwidths**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration**  **or single uplink carrier6** | **NR Band** | **Channel bandwidth (MHz) (NOTE 3)** | **Bandwidth combination set** |
| CA\_n3A-n7A-n79A | - | n3 | 5. 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n7 | 5. 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n79 | 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n3A-n7A-n79C | - | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n79 | CA\_n79C\_BCS0 |  |
| CA\_n3B-n7A-n79A | - | n3 | CA\_n3B\_BCS0 | 0 |
|  |  | n7 | 5. 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n79 | 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n3(2A)-n7A-n79A | - | n3 | CA\_n3(2A)\_BCS0 | 0 |
|  |  | n7 | 5. 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n79 | 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n3B-n7A-n79C | - | n3 | CA\_n3B\_BCS0 | 0 |
|  |  | n7 | 5. 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n79 | CA\_n79C\_BCS0 |  |
| CA\_n3(2A)-n7A-n79C | - | n3 | CA\_n3(2A)\_BCS0 | 0 |
|  |  | n7 | 5. 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n79 | CA\_n79C\_BCS0 |  |

#### 5.36.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n7-n79, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.36.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n7-n79 | 0.5 | 0.5 | 0.8 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.36.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3-n7-n79 | - | - | 0.5 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

#### 5.36.1.4 MSD requirement

Since CA\_n7-n79 is a fallback combination of CA\_n3-n7-n79, and the MSD due to near-miss 2nd harmonic interference for CA\_n7-n79 can be specified as below referring to DC\_7\_n79 in TS 38.101-3.

Table 5.36.1.4-1: Reference sensitivity exceptions and uplink/downlink configurations due to UL harmonic from a PC3 aggressor NR UL band for NR DL CA FR1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | DL band | UL BW | SCS of UL band | UL RB Allocation | DL BW | MSD | UL/DL fc condition | UL/DL harmonic order |
| (MHz) | (kHz) | LCRB | (MHz) | (dB) |
| n7 | n79 | 5 | 15 | 25 (Rbstart=0) | 10 | 1.1 | NOTE 6 | UL2/DL1  near-miss |
| NOTE 6: The requirements are only applicable to channel bandwidths no larger than 20 MHz and with a carrier frequency at  MHz offset from  in the victim (higher band) with , whereandare the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively. | | | | | | | | |

## 5.37 CA\_n3-n7-n67

### 5.37.1 Common for 1 band UL and 2 bands UL CA

#### 5.37.1.1 Operating bands for CA

Table 5.37.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n7-n67 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 12620MHz | – | 2690MHz | FDD |
| n67 |  | N/A |  | 783 MHz | – | 758 MHz | SDL |

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

Table 5.37.1.2-1: Supported bandwidths per CA band combination of band n3-n7-n67

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n7A-n67A | CA\_n3A-n7A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 |  |
|  |  | n67 | 5, 10, 15, 20 |  |

#### 5.37.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n7-n67, the ΔTIB,c and ΔRIB,c values are reused from DC\_3\_n7-n28 and are given in the tables below.

Table 5.37.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n7-n67 | 0.5 | 0.5 | - |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.37.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n7-n67 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.37.2 Specific for 2 bands UL CA

#### 5.37.2.1 UE co-existence studies

UL n3-n7 gives IMD2 into DL n67.

#### 5.37.2.2 REFSENS requirements

Based on the co-existence studies there is a need to define MSD values. MSD value from CA\_n3-n7-n28 is reused.

Table 5.37.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n7-n67 | n3 | 1770 | 5 | 25 | 1865 | N/A | FDD | N/A |
|  | n7 | 2520 | 5 | 25 | 2640 | N/A | FDD | N/A |
|  | n67 | N/A | 5 | 25 | 750 | 20 | SDL | IMD2 |

## 5.38 CA\_n1-n28-n46

### 5.38.1 Common for 1 band UL and 2 bands UL CA

#### 5.38.1.1 Operating bands for CA

Table 5.38.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band Combination** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n28-n46 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |

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

Table 5.38.1.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n28A-n46A | CA\_n1A-n28A  CA\_n1A-n46A  CA\_n28A-n46A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n46 | 10, 20, 40, 60, 80 |  |
| CA\_n1A-n28A-n46C | CA\_n1A-n28A  CA\_n1A-n46A  CA\_n28A-n46A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n46 | CA\_n46C\_BCS0 |  |
| CA\_n1A-n28A-n46D | CA\_n1A-n28A  CA\_n1A-n46A  CA\_n28A-n46A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n46 | CA\_n46D\_BCS0 |  |
| CA\_n1A-n28A-n46(2A) | CA\_n1A-n28A  CA\_n1A-n46A  CA\_n28A-n46A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20 |  |
|  |  | n46 | CA\_n46(2A)\_BCS0 |  |

#### 5.38.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n28-n46, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.38.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n28-n46 | 0.3 | 0.6 | - |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.38.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n28-n46 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.38.2 Specific for 2 bands UL CA

#### 5.38.2.1 Co-existence studies

It can be seen from the co-existence studies of the lower order CA configurations that the IMD products of the dual-UL may fall into the DL of the 3rd band in the following cases:

- IMD4 of band n1 UL and band n28 UL falls into band n46 DL

- IMD4 of band n1 UL and n46 UL falls into band n28 DL

- IMD5 of band n28 UL and n46 UL falls into band n1 DL

#### 5.38.2.2 REFSENs requirements

Due to the limitation of applicable channel bandwidths, it’s impossible to define the carrier frequencies for the test case of IMD5 of band n28 UL and n46 UL falling into band n1 DL. And the MSD for the NR-U band n46 is set to N/A.

**Table 5.38.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n1-n28-n46 | n1 | 1975 | 5 | 25 | 2165 | N/A | FDD | N/A |
| n28 | 710 | 5 | 25 | 765 | N/A | FDD | N/A |
| n46 | 5215 | 20 | 100 | 5215 | N/A | TDD | IMD4 |
| n1 | 1975 | 5 | 25 | 2165 | N/A | FDD | N/A |
| n28 | 710 | 5 | 25 | 765 | 10.5 | FDD | IMD4 |
| n46 | 5160 | 20 | 100 | 5160 | N/A | TDD | N/A |

## 5.39 CA\_n25-n41-n85

### 5.39.1 Common for 1 band UL and 2 bands UL CA

#### 5.39.1.1 Operating bands for CA

Table 5.39.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.39.1.2-1: Supported bandwidths per CA band combination of band n25+n41+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n25A-n41A-n85A | CA\_n25A-n41A  CA\_n25A-n85A  CA\_n41A-n85A | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | n41 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.39.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n25-n41-n85, the ΔTIB,c and ΔRIB,c values are reused from DC\_2-12\_n41and are given in the tables below.

Table 5.39.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n25-n41-n85 | 0.5 | 0.5 | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.39.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n25-n41-n85 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.39.2 Specific for 2 bands UL CA

#### 5.39.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations such as CA n25-n41, CA\_n25-n85 and n41-n85 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings:

– 2nd and 5th order IMD generated by dual uplink of Band n25 + Band n41 may fall into own Rx of Band n85.

– 2nd order IMD generated by dual uplink of Band n25 + Band n85 may fall into own Rx of Band n41.

– 2nd order IMD generated by dual uplink of Band n41 + Band n85 may fall into own Rx of Band n25.

#### 5.39.2.2 REFSENS requirements

Table 5.39.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for DC\_12A\_n2A-n41A and DC\_2A-12A\_n41A are reused.

Table 5.39.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n25-n41-n85 | n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
|  | n41 | 2638 | 10 | 50 | 2638 | N/A | TDD | N/A |
|  | n85 | 708 | 5 | 50 | 738 | 28.7 | FDD | IMD24 |
|  | n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
|  | n41 | 2608 | 5 | 25 | 2608 | 28.7 | TDD | IMD2 |
|  | n85 | 708 | 5 | 25 | 738 | N/A | FDD | N/A |
|  | n25 | 1872 | 5 | 25 | 1952 | 26 | FDD | IMD2 |
|  | n41 | 2660 | 10 | 50 | 2660 | N/A | TDD | N/A |
|  | n85 | 708 | 5 | 50 | 738 | N/A | FDD | N/A |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.40 CA\_n25-n77-n85

### 5.40.1 Common for 1 band UL and 2 bands UL CA

#### 5.40.1.1 Operating bands for CA

Table 5.40.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.40.1.2-1: Supported bandwidths per CA band combination of band n25+n77+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n25A-n77A-n85A | CA\_n25A-n77A  CA\_n25A-n85A  CA\_n77A-n85A | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.40.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n25-n77-n85, the ΔTIB,c and ΔRIB,c values are reused from CA\_n2-n12-n77 and are given in the tables below.

Table 5.40.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n25-n77-n85 | 0.6 | 0.8 | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.40.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n25-n77-n85 | 0.2 | 0.5 | 0.2 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.40.2 Specific for 2 bands UL CA

#### 5.40.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations such as CA n25-n77, CA\_n25-n85 and n77-n85 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings.

– No impact from dual uplink of Band n25 + Band n77 into own Rx of Band n85.

– 3rd and 4th order IMD generated by dual uplink of Band n77 + Band n85 may fall into own Rx of Band n25.

– 3rd, 4th and 5th order IMD generated by dual uplink of Band n25 + Band n85 may fall into own Rx of Band n77.

#### 5.40.2.2 REFSENS requirements

Table 5.40.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n2-n12-n77 are reused.

Table 5.40.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n25-n77-n85 | n25 | 1880 | 5 | 25 | 1960 | 16.5 | FDD | IMD32 |
|  | n77 | 3375 | 10 | 50 | 3375 | N/A | TDD | N/A |
|  | n85 | 707.5 | 5 | 25 | 737.5 | N/A | FDD | N/A |
|  | n25 | 1900 | 5 | 25 | 1980 | N/A | FDD | N/A |
|  | n77 | 3315 | 10 | 50 | 3315 | 16.0 | TDD | IMD31,2 |
|  | n85 | 707.5 | 5 | 25 | 737.5 | N/A | FDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.41 CA\_n28-n39-n40

### 5.41.1 Common for 1 band UL and 2 bands UL CA

#### 5.41.1.1 Operating bands for CA

Table 5.41.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n28-n39-n40 | n28, n39, n40 |

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

Table 5.41.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n28A-n39A-n40A | CA\_n28A-n39A  CA\_n28A-n40A  CA\_n39A-n40A | n28 | 5, 10, 15, 20, 30 | 0 |
|  |  | n39 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n40 | 5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 100 |  |

#### 5.41.1.3 ∆TIB,c and ∆RIB,c values

The ΔTIB,c and ΔRIB,c values have already been included in the spec.

### 5.41.2 Specific for 2 bands UL CA

#### 5.41.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n28A-n39A, CA\_n28A-n40A and CA\_n39A-n40A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD4 caused by n28+n39 may fall into the its own band n40 Rx, where the IMDx frequency range is: 2264~2434MHz.

No IMDx issue caused by n28+n40 fall into the its own band n39 Rx

IMD4 caused by n39+n40 may fall into the its own band n28 Rx, where the IMDx frequency range is 760~1040 MHz

#### 5.41.2.2 REFSENS requirements

In terms of the co-existence studies, the IMD4 caused by n28+n39 may fall into the its own band n40 Rx, however, simultaneous Rx/Tx is not supported for CA\_n39-n40 in current spec, which means synchronization between band n39 and n40. In the other words, there is no need to define IMD4 MSD caused by n28+n39 for band n40.

The MSD requirement for IMD4 caused by n39+n40 are defined in table 5.41.2.2-1:

Table 5.41.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n28-n39-n40 | n28 | 735 | 5 | 25 | 790 | 8.6 | FDD | IMD4 |
|  | n39 | 1915 | 5 | 25 | 1915 | N/A | FDD | N/A |
|  | n40 | 2310 | 5 | 25 | 2310 | N/A | FDD | N/A |

## 5.42 CA\_n1-n46-n78

### 5.42.1 Common for 1 band UL and 2 bands UL CA

#### 5.42.1.1 Operating bands for CA

Table 5.42.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band Combination** | **NR Band** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex**  **mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n46-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |
| n78 | 3300MHz | – | 3800MHz | 3300MHz | – | 3800MHz | TDD |

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

Table 5.42.1.2-1: Supported channel bandwidths per CA configuration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n46A-n78A | CA\_n1A-n46A  CA\_n1A-n78A  CA\_n46A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n46 | 10, 20, 40, 60, 80 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n1A-n46C-n78A | CA\_n1A-n46A  CA\_n1A-n78A  CA\_n46A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n46 | CA\_n46C\_BCS0 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n1A-n46D-n78A | CA\_n1A-n46A  CA\_n1A-n78A  CA\_n46A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n46 | CA\_n46D\_BCS0 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n1A-n46(2A)-n78A | CA\_n1A-n46A  CA\_n1A-n78A  CA\_n46A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n46 | CA\_n46(2A)\_BCS0 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n1A-n46A-n78(2A) | CA\_n1A-n46A  CA\_n1A-n78A  CA\_n46A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n78(2A) | n46 | 10, 20, 40, 60, 80 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
| CA\_n1A-n46C-n78(2A) | CA\_n1A-n46A  CA\_n1A-n78A  CA\_n46A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n78(2A) | n46 | CA\_n46C\_BCS0 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
| CA\_n1A-n46D-n78(2A) | CA\_n1A-n46A  CA\_n1A-n78A  CA\_n46A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n78(2A) | n46 | CA\_n46D\_BCS0 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
| CA\_n1A-n46(2A)-n78(2A) | CA\_n1A-n46A  CA\_n1A-n78A  CA\_n46A-n78A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n78(2A) | n46 | CA\_n46(2A)\_BCS0 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |

#### 5.42.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n46-n78, the ΔTIB,c and ΔRIB,c values are proposed in the tables below.

Table 5.42.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n46-n78 | 0.3 | - | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.42.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n46-n78 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.42.2 Specific for 2 bands UL CA

#### 5.42.2.1 Co-existence studies

It can be seen from the co-existence studies of the lower order CA configurations that the IMD products of the dual-UL may fall into the DL of the 3rd band in the following cases:

- IMD2 of band n1 UL and band n46 UL falls into band n78 DL

- IMD2 of band n46 UL and n78 UL falls into band n1 DL

- IMD3 of band n46 UL and n78 UL falls into band n1 DL

- IMD2 of band n1 UL and n78 UL falls into band n46 DL

- IMD3 of band n1 UL and n78 UL falls into band n46 DL

#### 5.42.2.2 REFSENs requirements

The MSD requirements are proposed as in the table below. The MSD for band n46 is set to N/A, since it’s a NR-U band.

Table 5.42.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA**  **Configuration** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |
| CA\_n1-n46-n78 | n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n46 | 5430 | 20 | 50 | 5430 | N/A | TDD | N/A |
| n78 | 3500 | 10 | 50 | 3500 | 29 | TDD | IMD2 |
| n1 | 1940 | 5 | 25 | 2130 | 30 | FDD | IMD2 |
| n46 | 5630 | 20 | 50 | 5630 | N/A | TDD | N/A |
| n78 | 3500 | 10 | 50 | 3500 | N/A | TDD | N/A |
| n1 | 1930 | 5 | 25 | 2120 | 15 | FDD | IMD3 |
| n46 | 5160 | 20 | 50 | 5160 | N/A | TDD | N/A |
| n78 | 3640 | 10 | 50 | 3640 | N/A | TDD | N/A |
| n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n46 | 5430 | 20 | 50 | 5430 | N/A | TDD | IMD2 |
| n78 | 3500 | 10 | 50 | 3500 | N/A | TDD | N/A |
| n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
| n46 | 5250 | 20 | 50 | 5250 | N/A | TDD | IMD3 |
| n78 | 3590 | 10 | 50 | 3590 | N/A | TDD | N/A |

## 5.43 CA\_n25-n66-n85

### 5.43.1 Common for 1 band UL and 2 bands UL CA

#### 5.43.1.1 Operating bands for CA

Table 5.43.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.43.1.2-1: Supported bandwidths per CA band combination of band n25+n66+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n25A-n66A-n85A | CA\_n25A-n66A  CA\_n25A-n85A  CA\_n66A-n85A | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.43.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n25-n66-n85, the ΔTIB,c and ΔRIB,c values are reused from DC\_2-12\_n66 and are given in the tables below.

Table 5.43.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n25-n66-n85 | 0.5 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.43.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n25-n66-n85 | 0.3 | 0.3 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.43.2 Specific for 2 bands UL CA

#### 5.43.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations such as CA n25-n66, CA\_n25-n85 and n66-n85 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings.

– No impact from dual uplink of Band n25 + Band n85 into own Rx of Band n66.

– No impact from dual uplink of Band n25 + Band n66 into own Rx of Band n85.

– 4th order IMD generated by dual uplink of Band n66 + Band n85 may fall into own Rx of Band n25.

#### 5.43.2.2 REFSENS requirements

Table 5.43.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for DC\_2A-66A\_n28A are reused.

Table 5.43.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n25-n66-n85 | n25 | 1912.5 | 5 | 25 | 1992.5 | 11.0 | FDD | IMD4 |
|  | n66 | 1712.5 | 5 | 25 | 2112.5 | N/A | FDD | N/A |
|  | n85 | 713.5 | 5 | 25 | 743.5 | N/A | FDD | N/A |

## 5.44 CA\_n3-n7-n67

### 5.44.1 Common for 1 band UL and 2 bands UL CA

#### 5.44.1.1 Operating bands for CA

Table 5.44.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n41 | 2496 MHz | – | 2690MHz | 2496 MHz | – | 2690MHz | TDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.44.1.2-1: Supported bandwidths per CA band combination of band n41+n77+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n41A-n77A-n85A | CA\_n41A-n77A  CA\_n41A-n85A  CA\_n77A-n85A | n41 | n41 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.44.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n41-n77-n85, the ΔTIB,c and ΔRIB,c values are reused from CA\_n12-n41-n77 and are given in the tables below.

Table 5.44.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n41-n77-n85 | 0.6 | 0.8 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.44.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n41-n77-n85 | 0.5 | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.44.2 Specific for 2 bands UL CA

#### 5.44.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations such as CA n41-n77, CA\_n41-n85 and n77-n85 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings.

– 2nd order IMD generated by dual uplink of Band n41 + Band n77 into own Rx of Band n85.

– 2nd and 3rd order IMD generated by dual uplink of Band n77 + Band n85 may fall into own Rx of Band n41.

– 2nd and 3rd order IMD generated by dual uplink of Band n41 + Band n85 may fall into own Rx of Band n77.

#### 5.44.2.2 REFSENS requirements

Table 5.44.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for DC\_41A\_n28A-n77A and DC\_28A-41A\_n77A are reused.

Table 5.44.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n41-n77-n85 | n41 | 2687 | 5 | 25 | 2687 | N/A | TDD | N/A |
|  | n77 | 3420 | 10 | 50 | 3420 | N/A | TDD | N/A |
|  | n85 | 703 | 5 | 25 | 733 | 30.8 | FDD | IMD26 |
|  | n41 | 2 619 | 5 | 25 | 2 619 | 29.5 | TDD | IMD24.6 |
|  | n77 | 3320 | 10 | 50 | 3320 | N/A | TDD | N/A |
|  | n85 | 701 | 5 | 25 | 731 | N/A | FDD | N/A |
|  | n41 | 2680 | 5 | 25 | 2680 | N/A | TDD | N/A |
|  | n77 | 3393 | 10 | 50 | 3393 | 28.2 | TDD | IMD24,6 |
|  | n85 | 713 | 5 | 25 | 743 | N/A | FDD | N/A |
| NOTE 4: This band is subject to IMD3 also which MSD is not specified.  NOTE 6:   This band is subjected to 2nd order IMD but is not expected for the operating frequency range of n77 within USA (3450 – 3550 MHz, 3700 – 3980 MHz). | | | | | | | | |

## 5.45 CA\_n66-n77-n85

### 5.45.1 Common for 1 band UL and 2 bands UL CA

#### 5.45.1.1 Operating bands for CA

Table 5.45.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.45.1.2-1: Supported bandwidths per CA band combination of band n66+n77+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n66A-n77A-n85A | CA\_n66A-n77A  CA\_n66A-n85A  CA\_n77A-n85A | n66 | n66 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n77 | n77 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.45.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n66-n77-n85, the ΔTIB,c and ΔRIB,c values are reused from CA\_n12-n66-n77 and are given in the tables below.

Table 5.45.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n66-n77-n85 | 0.6 | 0.8 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.45.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n66-n77-n85 | 0.5 | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.45.2 Specific for 2 bands UL CA

#### 5.45.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations such as CA n66-n77, CA\_n66-n85 and n77-n85 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings.

– 3rd order IMD generated by dual uplink of Band n66 + Band n77 into own Rx of Band n85.

– 3rd order IMD generated by dual uplink of Band n77 + Band n85 may fall into own Rx of Band n66.

#### 5.45.2.2 REFSENS requirements

Table 5.45.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n12-n66-n77 and are reused.

Table 5.45.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n66-n77-n85 | n66 | 1720 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n77 | 4180 | 10 | 50 | 4180 | N/A | TDD | N/A |
|  | n85 | 710 | 5 | 25 | 740 | 23.5 | FDD | IMD35 |
|  | n66 | 1724 | 5 | 25 | 2124 | 21.4 | FDD | IMD3 |
|  | n77 | 3540 | 10 | 50 | 3540 | N/A | TDD | N/A |
|  | n85 | 708 | 5 | 25 | 738 | N/A | FDD | N/A |
| NOTE 5: For a UE which supports this band combination only when the Band n77 frequency range restriction defined in NOTE 12 of Table 5.2-1 applies, the MSD test point(s) cannot be verified for the band combination and the test point(s) can be skipped. | | | | | | | | |

## 5.46 CA\_n1-n7-n67

### 5.46.1 Common for 1 band UL and 2 bands UL CA

#### 5.46.1.1 Operating bands for CA

Table 5.46.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n7-n67 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n67 | N/A | – | N/A | 738 MHz | – | 758 MHz | SDL |

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

Table 5.46.1.2-1: Supported bandwidths per CA band combination of band n1+n7+n67

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n7A-n67A | CA\_n1A-n7A | n1 | 5, 10, 15, 20, 30, 40, 45, 50 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 |  |
|  |  | n67 | 5, 10, 15, 20 |  |

#### 5.46.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n7-n67, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n18-n41 and are given in the tables below.

Table 5.46.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n7-n67 | 0.5 | 0.5 | - |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.46.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n7-n67 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.46.2 Specific for 2 bands UL CA

#### 5.46.2.1 UE co-existence studies

UL n1-n7 gives IMD5 into DL n67.

#### 5.46.2.2 REFSENS requirements

Based on the co-existence studies there is a need to define MSD values. MSD value from CA\_n1-n18-n41 is reused.

Table 5.46.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n7-n67 | n1 | 1948 | 5 | 25 | 2138 | N/A | FDD | N/A |
|  | n7 | 2548 | 5 | 25 | 2668 | N/A | FDD | N/A |
|  | n67 | N/A | 5 | 25 | 748 | 3.3 | SDL | IMD5 |

## 5.47 CA\_n1-n67-n78

### 5.47.1 Common for 1 band UL and 2 bands UL CA

#### 5.47.1.1 Operating bands for CA

Table 5.47.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n67-n78 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n67 | N/A | – | N/A | 738 MHz | – | 758 MHz | SDL |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.47.1.2-1: Supported bandwidths per CA band combination of band n1+67+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A- n67A-n78A | CA\_n1A-n78A | n1 | 5, 10, 15, 20, 30, 40, 45, 50 | 0 |
|  |  | n67 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n1A-n67A-n78(2A) | CA\_n1A-n78A CA\_n78(2A) | n1 | 5, 10, 15, 20, 30, 40, 45, 50 | 0 |
|  |  | n67 | 5, 10, 15, 20 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |

#### 5.47.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n67-n78, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n18-n77 and are given in the tables below.

Table 5.47.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n67-n78 | 0.3 | - | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.47.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n67-n78 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.47.2 Specific for 2 bands UL CA

#### 5.47.2.1 UE co-existence studies

UL n1-n78 gives IMD5 into DL n67.

#### 5.47.2.2 REFSENS requirements

Based on the co-existence studies there is a need to define MSD values. MSD value from CA\_n1-n18-n41 is reused.

Table 5.47.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n67-n78 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n67 | N/A | 5 | 25 | 748 | 3.5 | SDL | IMD5 |
|  | n78 | 3329 | 10 | 50 | 3329 | N/A | TDD | N/A |

## 5.48 CA\_n3-n8-n79

### 5.48.1 Common for 1 band UL and 2 bands UL CA

#### 5.48.1.1 Operating bands for CA

Table 5.48.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n3-n8-n79 | n3, n8, n79 |

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

Table 5.48.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n8A-n79A | CA\_n3A-n8A  CA\_n3A-n79A  CA\_n8A-n79A | n3 | 5, 10, 15, 20, 25, 30 | 0 |
|  |  | n8 | 5, 10, 15, 20 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |

#### 5.48.1.3 ∆TIB,c and ∆RIB,c values

The ΔTIB,c and ΔRIB,c values have already been included in the spec.

### 5.48.2 Specific for 2 bands UL CA

#### 5.48.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n3A-n8A, CA\_n3A-n79A and CA\_n8A-n79A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD3 and IMD4 caused by n3+n8 may fall into the its own band n79 Rx, where the IMDx frequency range are:

- 4300~4485 MHz for IMD3 caused by UL CA\_n3-n8

- 4350 ~4530MHz and 4215 ~ 4475 MHz for IMD4 caused by UL CA\_n3-n8

IMD3 and IMD4 caused by n3+n79 may fall into the its own band n8 Rx, where the IMDx frequency range are:

- 830~1580MHz for IMD3 caused by UL CA\_n3-n79

- 130~955 MHz for IMD4 caused by UL CA\_n3-n79

IMD4 caused by n8+n79 may fall into the its own band n3 Rx, where the IMDx frequency range is 1655~2360 MHz

#### 5.48.2.2 REFSENS requirements

For other MSD requirements, it is proposed to re-use the MSD values of DC\_3-8\_n79 and DC\_8\_n3-n79. Therefore, the MSD requirement are defined in table 5.48.2.2-1:

Table 5.48.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n8-n79 | n3 | 1770 | 5 | 25 | 1865 | N/A | FDD | N/A |
|  | n8 | 885 | 5 | 25 | 930 | N/A | FDD | N/A |
|  | n79 | 4425 | 40 | 216 | 4425 | 15.7 | TDD | IMD32 |
|  | n3 | 1755 | 5 | 25 | 1850 | N/A | FDD | N/A |
|  | n8 | 910 | 5 | 25 | 955 | 15.3 | FDD | IMD3 |
|  | n79 | 4465 | 40 | 216 | 4465 | N/A | FDD | N/A |
|  | n3 | 1755 | 5 | 25 | 1850 | 8.8 | FDD | IMD4 |
|  | n8 | 910 | 5 | 25 | 955 | N/A | FDD | N/A |
|  | n79 | 4580 | 40 | 216 | 4580 | N/A | FDD | N/A |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.49 CA\_n3-n7-n8

### 5.49.1 Common for 1 band UL and 2 bands UL CA

#### 5.49.1.1 Operating bands for CA

Table 5.49.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n8 | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |

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

Table 5.49.1.2-1: Supported bandwidths per CA band combination of band n3+n7+n8

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n7A-n8A | **CA\_n3A-n7A**  **CA\_n3A-n8A**  **CA\_n7A-n8A** | n3 | 5, 10, 15, 20, 25, 30, 35, 40, 50 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 |  |
|  |  | n8 | 5, 10, 15, 20, 35 |  |

#### 5.49.1.3 ∆TIB,c and ∆RIB,c values

Note that CA\_n3A-n7A-n8A 1UL/3DL CA had been introduced in Rel.17 38.101-1, related sections for 1UL/3DL CA can be found in TR 38.717-03-01 section 6.129.

### 5.49.2 Specific for 2 bands UL CA

#### 5.49.2.1 UE co-existence studies

Since the UE co-existence tables have already been provided in 2DL/2UL fallback combinations, CA\_n3-n7, CA\_n3-n8, CA\_n7-n8, which are studied in section 6.73, 6.19 of TR 38.716-02-00, and section 5.34 of TR 38.718-02-01 respectively, here we list the own Rx impact on the 3rd band below.

- The 3rd IMD generated by dual uplink of Band n3 + Band n7 will fall into own Rx of Band n8.

- The 2nd and 3rd IMD generated by dual uplink of Band n3 + Band n8 will fall into own Rx of Band n7.

- No IMD generated by dual uplink of Band n7 + Band n8 will fall into own Rx of Band n3.

#### 5.49.2.2 REFSENS requirements

The table below lists the MSD required for the dual uplink CA configuration for the cases that IMD interference falls into the own 3rd Rx frequency band. The MSD values are derived from DC\_3-7\_n8 and DC\_7-8\_n3 in TS 38.101-3.

Table 5.49.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n7-n8 | n3 | 1735 | 5 | 25 | 1830 | N/A | FDD | N/A |
|  | n7 | 2530 | 10 | 50 | 2650 | N/A | FDD | N/A |
|  | n8 | 895 | 5 | 25 | 940 | 18.0 | FDD | IMD3 |
|  | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
|  | n7 | 2550 | 10 | 50 | 2670 | 29.0 | FDD | IMD2+IMD3x |
|  | n8 | 890 | 5 | 25 | 935 | N/A | FDD | N/A |
| NOTE x: This MSD requirement apply with both IMD2 and IMD3 products should be generated. | | | | | | | | |

Note that for the overlapped IMD2+IMD3 case in the above table, the third harmonic generated by n8 UL will also fall on top of the n7 downlink block, however based on the MSD analysis for LTE CA\_3A-7A-8A 2UL/3DL in TR 36.714-00-02, it was found that the the impact of the third harmonic is negligible since it is more than 20dB below the MSD due to IMD2 and IMD3. Therefore the statement that “it is agreed “H3” is not included in the MSD table” in TR 36.714-00-02 is also applied in this case.

## 5.50 CA\_n8-n39-n41

### 5.50.1 Common for 1 band UL and 2 bands UL CA

#### 5.50.1.1 Operating bands for CA

Table 5.50.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| n8A-n39A-n41A | n8, n39, n41 |

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

Table 5.50.1.2-1: Supported bandwidths per CA band combination of band n8+n39+n41

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n8A-n39A-n41A | CA\_n8A-n39A  CA\_n8A-n41A  CA\_n39A-n41A | n8 | 5, 10, 15, 20 | 0 |
|  |  | n39 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n41 | 10, 15, 20, 40, 50, 60, 80, 100 |  |

#### 5.50.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n8-n39-n41, the ΔTIB,c and ΔRIB,c values have already been defined in the spec.

### 5.50.2 Specific for 2 bands UL CA

#### 5.50.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n8A-n39A, CA\_n8A-n41A and CA\_n39A-n41A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

No IMDx issue caused by n8+n39 fall into its own band n41Rx;

No IMDx issue caused by n39+n41 fall into its own band n8 Rx;

No IMDx issue caused by n8+n41 fall into its own band n39 Rx.

#### 5.50.2.2 REFSENS requirements

In terms of the co-existence studies, there are no additional MSD requirements.

## 5.51 CA\_n8-n39-n79

### 5.51.1 Common for 1 band UL and 2 bands UL CA

#### 5.51.1.1 Operating bands for CA

Table 5.51.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| n8A-n39A-n79A | n8, n39, n79 |

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

Table 5.51.1.2-1: Supported bandwidths per CA band combination of band n8+n39+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n8A-n39A-n79A | CA\_n8A-n39A  CA\_n8A-n79A  CA\_n39A-n79A | n8 | 5, 10, 15, 20 | 0 |
|  |  | n39 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |

#### 5.51.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n8-n39-n79, the ΔTIB,c and ΔRIB,c values have already been defined in the spec.

### 5.51.2 Specific for 2 bands UL CA

#### 5.51.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n8A-n39A, CA\_n8A-n79A and CA\_n39A-n79A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD3 and IMD4 issue caused by n8+n39 fall into its own band n79 Rx;

IMD3 and IMD4 issue caused by n39+n79 fall into its own band n8 Rx;

IMD4 issue caused by n8+n79 fall into its own band n39 Rx.

#### 5.51.2.2 REFSENS requirements

Based on co-existence studies additional MSD is needed to be defined, shown in table 5.51.2.2-1., where some MSD requirements are reused form DC\_8\_n39-n79.

Table 5.51.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| CA\_n8-n39-n79 | n8 | 900 | 5 | 25 | 945 | N/A | N/A |
|  | n39 | 1890 | 10 | 50 | 1890 | N/A | N/A |
|  | n79 | N/A | 40 | N/A | 4680 | 15.9 | IMD3 |
|  | n8 | 890 | 5 | 25 | 935 | N/A | N/A |
|  | n39 | 1890 | 10 | 50 | 1890 | N/A | N/A |
|  | n79 | N/A | 40 | N/A | 4560 | 12.1 | IMD4 |
|  | n8 | 897.5 | 5 | 25 | 942.5 | N/A | N/A |
|  | n39 | N/A | 10 | N/A | 1907.5 | 13.8 | IMD4 |
|  | n79 | 4600 | 40 | 216 | 4600 | N/A | N/A |
|  | n8 | N/A | 5 | N/A | 940 | 15.1 | IMD3 |
|  | n39 | 1900 | 10 | 50 | 1900 | N/A | N/A |
|  | n79 | 4740 | 40 | 216 | 4740 | N/A | N/A |
|  | n8 | N/A | 5 | N/A | 940 | 7.1 | IMD4 |
|  | n39 | 1900 | 10 | 50 | 1900 | N/A | N/A |
|  | n79 | 4750 | 40 | 216 | 4750 | N/A | N/A |

## 5.52 CA\_n7-n67-n78

### 5.52.1 Common for 1 band UL and 2 bands UL CA

#### 5.52.1.1 Operating bands for CA

Table 5.52.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n67-n78 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n67 | N/A | – | N/A | 738 MHz | – | 758 MHz | SDL |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.52.1.2-1: Supported bandwidths per CA band combination of band n1+67+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A- n67A-n78A | CA\_n7A-n78A | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 | 0 |
|  |  | n67 | 5, 10, 15, 20 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n7A-n67A-n78(2A) | CA\_n7A-n78A CA\_n78(2A) | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 | 0 |
|  |  | n67 | 5, 10, 15, 20 |  |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |

#### 5.52.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n67-n78, the ΔTIB,c values are reused from CA\_n7-n78 and ΔRIB,c values are reused from CA\_n7-n28-n78, and are given in the tables below.

Table 5.52.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7-n67-n78 | 0.5 | - | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n7-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.52.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7-n67-n78 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n7-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.52.2 Specific for 2 bands UL CA

#### 5.52.2.1 UE co-existence studies

UL n1-n78 gives IMD2 and IMD5 into DL n67.

#### 5.52.2.2 REFSENS requirements

Based on the co-existence studies there is a need to define MSD values. MSD value from CA\_n7-n28-n78 is reused.

Table 5.52.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n67-n78 | n7 | 2562 | 5 | 25 | 2682 | N/A | FDD | N/A |
|  | n67 | N/A | 5 | 25 | 748 | 28.8 | SDL | IMD21 |
|  | n78 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.53 CA\_n41-n66-n85

### 5.53.1 Common for 1 band UL and 2 bands UL CA

#### 5.53.1.1 Operating bands for CA

Table 5.53.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.53.1.2-1: Supported bandwidths per CA band combination of band n41+n66+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n41A-n66A-n85A | CA\_n41A-n66A  CA\_n41A-n85A  CA\_n66A-n85A | n41 | n41 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.53.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n41-n66-n85, the ΔTIB,c and ΔRIB,c values are reused from DC\_12A-66A\_n41A and are given in the tables below.

Table 5.53.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n41-n66-n85 | 0.81 / 1.32 | 0.5 | 0.6 |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545 – 2690 MHz.  NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496 – 2545 MHz.  NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.53.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n41-n66-n85 | 0.51 / 12 | 0.5 | 0.5 |
| NOTE 1: The requirement is applied for UE transmitting on the frequency range of 2545 – 2690 MHz.  NOTE 2: The requirement is applied for UE transmitting on the frequency range of 2496 – 2545 MHz.  NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.53.2 Specific for 2 bands UL CA

#### 5.53.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations: CA n41-n66, CA\_n41-n85 and n66-n85 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings:

– 2nd and 3rd order IMD generated by dual uplink of Band n41 + Band n66 may fall into own Rx of Band n85.

– 2nd order IMD generated by dual uplink of Band n66 + Band n85 may fall into own Rx of Band n41.

#### 5.53.2.2 REFSENS requirements

Table 5.53.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for DC\_12A-66A\_n41A and DC\_7A-13A\_n25A are reused.

Table 5.53.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n41-n66-n85 | n41 | 2498.5 | 5 | 25 | 2498.5 | 27.6 | TDD | IMD2 |
|  | n66 | 1777.5 | 5 | 25 | 2197.5 | N/A | FDD | N/A |
|  | n85 | 713.5 | 5 | 25 | 743.5 | N/A | FDD | N/A |
|  | n41 | 2501 | 5 | 25 | 2501 | N/A | TDD | N/A |
|  | n66 | 1770 | 5 | 25 | 2190 | N/A | FDD | N/A |
|  | n85 | 701 | 5 | 25 | 731 | 31 | FDD | IMD21 |
| NOTE 1: This band is subject to IMD3 also which MSD is not specified. | | | | | | | | |

## 5.54 CA\_n1-n28-n102

### 5.54.1 Common for 1 band UL and 2 bands UL CA

#### 5.54.1.1 Operating bands for CA

Table 5.54.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n28-n102 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
|  | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
|  | n102 | 5925 MHz | – | 6425 MHz | 5925 MHz | – | 6425 MHz | TDD |

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

Table 5.54.1.2-1: Supported bandwidths per CA band combination of band n1+n28+n102

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n28A-n102A | CA\_n1A-n28A  CA\_n1A-n102A  CA\_n28A-n102A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20, 30 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n1A-n28A-n102B | CA\_n1A-n28A  CA\_n1A-n102A  CA\_n1A-n102B  CA\_n28A-n102A  CA\_n28A-n102B | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20, 30 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n1A-n28A-n102C | CA\_n1A-n28A  CA\_n1A-n102A  CA\_n1A-n102C  CA\_n28A-n102A  CA\_n28A-n102C | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20, 30 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n1A-n28A-n102D | CA\_n1A-n28A  CA\_n1A-n102A  CA\_n28A-n102A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20, 30 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n1A-n28A-n102E | CA\_n1A-n28A  CA\_n1A-n102A  CA\_n28A-n102A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20, 30 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n1A-n28A-n102(2A) | CA\_n1A-n28A  CA\_n1A-n102A  CA\_n28A-n102 | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n28 | 5, 10, 15, 20, 30 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |

#### 5.54.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n28-n102, the ΔTIB,c and ΔRIB,c values are taken from fallbacks.

Table 5.54.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n28-n102 | 0.6 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.54.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n28-n102 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.54.2 Specific for 2 bands UL CA

#### 5.54.2.1 UE co-existence studies

This is a 3-band combination, so uplink harmonic and harmonic mixing analysis is already done in the fallbacks. Only IMD for two uplink configurations is analysed.

Table 5.54.2.2-1 lists Band n1 + Band n28 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.54.2.2-2 lists Band n1 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.54.2.2-3 lists Band n28 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.54.2.1-1: Band n1 and Band n28 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 703 | 748 |
| DL Frequency [MHz] | 2110 | 2170 | 758 | 803 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1277 | 1172 | 2623 | 2728 |
| 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) | 3092 | 3257 | 574 | 424 |
| 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) | 4543 | 4708 | 3326 | 3476 |
| 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) | 5012 | 5237 | 129 | 324 |
| 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) | 2344 | 2554 | 5246 | 5456 |
| 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) | 6463 | 6688 | 4029 | 4224 |
| 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) | 1072 | 832 | 7217 | 6932 |
| 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) | 1596 | 1851 | 4534 | 4264 |
| 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) | 4732 | 4972 | 8383 | 8668 |
| 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) | 5949 | 6204 | 7166 | 7436 |

**Table 5.54.2.1-2: Band n1 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 5925 | 6425 |
| DL Frequency [MHz] | 2110 | 2170 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3945 | 4505 | 7845 | 8405 |
| 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) | 2585 | 1965 | 9870 | 10930 |
| 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) | 9765 | 10385 | 13770 | 14830 |
| 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) | 665 | 15 | 15795 | 17355 |
| 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) | 9010 | 7890 | 15690 | 16810 |
| 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) | 11685 | 12365 | 19695 | 21255 |
| 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) | 23780 | 21720 | 1995 | 1255 |
| 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) | 15435 | 13815 | 5910 | 7090 |
| 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) | 25620 | 27680 | 13605 | 14345 |
| 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) | 21615 | 23235 | 17610 | 18790 |

**Table 5.54.2.1-3: Band n28 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 703 | 748 | 5925 | 6425 |
| DL Frequency [MHz] | 758 | 803 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 5177 | 5722 | 6628 | 7173 |
| 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) | 5019 | 4429 | 11102 | 12147 |
| 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) | 7331 | 7921 | 12553 | 13598 |
| 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) | 4316 | 3681 | 17027 | 18572 |
| 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) | 11444 | 10354 | 13256 | 14346 |
| 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) | 8034 | 8669 | 18478 | 20023 |
| 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) | 24997 | 22952 | 2933 | 3613 |
| 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) | 17869 | 16279 | 9606 | 10741 |
| 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) | 24403 | 26448 | 8737 | 9417 |
| 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) | 19181 | 20771 | 13959 | 15094 |

Based on the tables above it can be seen that

n1 + n28 IMD5 may affect Rx frequencies of band n102

Table 5.54.2.1-4 lists Band n1 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n28, where Band n102C is the uplink band of the separated RB allocations and Band n1 is the contiguous single uplink carrier.

**Table 5.54.2.1-4: Band n1 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5965 | 6385 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 1920 | 1980 | 6405 | 6265 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 1760 | 1940 | 1960 | 2140 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 9890 | 10910 | 13790 | 14810 |  |  |

Based on Table 5.54.2.1-4, 1st order triple beat IMD has no occurrence in band n28. There is no change to the REFSENS requirements as there is no triple beat IMD.

Table 5.54.2.1-5 lists Band n28 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n1, where Band n102C is the uplink band of the separated RB allocations and Band n28 is the contiguous single uplink carrier.

**Table 5.54.2.1-5: Band n28 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5965 | 6385 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 703 | 748 | 6405 | 6265 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 543 | 723 | 728 | 908 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 11122 | 12127 | 12573 | 13578 |  |  |

Based on Table 5.54.2.1-5, 1st order triple beat IMD has no occurrence in band n1. There is no change to the REFSENS requirements as there is no triple beat IMD.

#### 5.54.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from DC\_8A\_n28-n79 are reused, for IMD5 into n102. This is the only combination that creates a 5th order IMD in the highest band, although 8A and n1 are distant in frequency, but so is n79 and n102. For IMD5 MSD 0.0dB could be used which is the same as for the case in DC\_8A\_n28-n79, which essentially asks for the test to prove that the UE is compliant with no relaxation despite the presence of the IMD product. However, given n102 is a shared spectrum access band the MSD is left as N/A.

Table 5.54.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n28-n102 | n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n28 | 706 | 5 | 25 | 761 | N/A | FDD | N/A |
|  | n102 | 5978 | 40 | 216 | 5978 | N/A11 | TDD | IMD5 |
| NOTE 11: This is a share spectrum access band, hence no MSD is defined. | | | | | | | | |

## 5.55 CA\_n1-n78-n102

### 5.55.1 Common for 1 band UL and 2 bands UL CA

#### 5.55.1.1 Operating bands for CA

Table 5.55.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n78-n102 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
|  | n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
|  | n102 | 5925 MHz | – | 6425 MHz | 5925 MHz | – | 6425 MHz | TDD |

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

Table 5.55.1.2-1: Supported bandwidths per CA band combination of band n1+n78+n102

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n78A-n102A | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n78A-n102A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n1A-n78A-n102B | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n1A-n102B  CA\_n78A-n102A  CA\_n78A-n102B | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n1A-n78A-n102C | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n1A-n102C  CA\_n78A-n102A  CA\_n78A-n102C | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n1A-n78A-n102D | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n78A-n102A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n1A-n78A-n102E | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n78A-n102A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n1A-n78A-n102(2A) | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n78A-n102A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n1A-n78(2A)-n102A | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n1 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n1A-n78(2A)-n102B | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n1A-n102B  CA\_n78A-n102A  CA\_n78A-n102B CA\_n78(2A) | n1 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n1A-n78(2A)-n102C | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n1A-n102C  CA\_n78A-n102A  CA\_n78A-n102C  CA\_n78(2A) | n1 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n1A-n78(2A)-n102D | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n1 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n1A-n78(2A)-n102E | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n1 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n1A-n78(2A)-n102(2A) | CA\_n1A-n78A  CA\_n1A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n1 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |

#### 5.55.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n78-n102, the ΔTIB,c and ΔRIB,c values are taken from fallbacks.

Table 5.55.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n78-n102 | 0.6 | 1.5 | 1.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.55.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n78-n102 | 0.2 | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.55.2 Specific for 2 bands UL CA

#### 5.55.2.1 UE co-existence studies

This is a 3-band combination, so uplink harmonic and harmonic mixing analysis is already done in the fallbacks. Only IMD for two uplink configurations is analysed.

Table 5.55.2.2-1 lists Band n1 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.55.2.2-2 lists Band n1 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.55.2.2-3 lists Band n78 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.55.2.1-1: Band n1 and Band n78 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 3300 | 3800 |
| DL Frequency [MHz] | 2110 | 2170 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320 | 1880 | 5220 | 5780 |
| 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) | 40 | 660 | 4620 | 5680 |
| 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) | 7140 | 7760 | 8520 | 9580 |
| 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) | 1960 | 2640 | 7920 | 9480 |
| 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) | 3760 | 2640 | 10440 | 11560 |
| 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) | 9060 | 9740 | 11820 | 13380 |
| 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) | 13280 | 11220 | 4620 | 3880 |
| 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) | 7560 | 5940 | 660 | 1840 |
| 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) | 15120 | 17180 | 10980 | 11720 |
| 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) | 13740 | 15360 | 12360 | 13540 |

**Table 5.55.2.1-2: Band n1 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 5925 | 6425 |
| DL Frequency [MHz] | 2110 | 2170 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3945 | 4505 | 7845 | 8405 |
| 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) | 2585 | 1965 | 9870 | 10930 |
| 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) | 9765 | 10385 | 13770 | 14830 |
| 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) | 665 | 15 | 15795 | 17355 |
| 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) | 9010 | 7890 | 15690 | 16810 |
| 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) | 11685 | 12365 | 19695 | 21255 |
| 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) | 23780 | 21720 | 1995 | 1255 |
| 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) | 15435 | 13815 | 5910 | 7090 |
| 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) | 25620 | 27680 | 13605 | 14345 |
| 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) | 21615 | 23235 | 17610 | 18790 |

**Table 5.55.2.1-3: Band n78 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3300 | 3800 | 5925 | 6425 |
| DL Frequency [MHz] | 3300 | 3800 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2125 | 3125 | 9225 | 10225 |
| 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) | 175 | 1675 | 8050 | 9550 |
| 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) | 12525 | 14025 | 15150 | 16650 |
| 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) | 3475 | 5475 | 13975 | 15975 |
| 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) | 6250 | 4250 | 18450 | 20450 |
| 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) | 15825 | 17825 | 21075 | 23075 |
| 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) | 22400 | 19900 | 9275 | 6775 |
| 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) | 12675 | 10175 | 450 | 2950 |
| 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) | 27000 | 29500 | 19125 | 21625 |
| 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) | 24375 | 26875 | 21750 | 24250 |

Based on the tables above it can be seen that

n1 + n78 IMD5 may affect Rx frequencies of band n102

n78 + n102 IMD2 and IMD5 may affect Rx frequencies of band n1

The non-contiguous uplink IMD interference analysis has been completed in the fallbacks. For CA\_n1A-n78(2A) with ULCA CA\_n78(2A) the analysis was completed in R4-2220561 of RAN4#105 but missed in specification updates. The values are re-iterated below from R4-2220561:

Table 7.3A.5-1: 2DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations for PC3 CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n78 | n1 | 1950 | 5 | 25 | 2140 | 8.0 | FDD | IMD4 |
|  | n78 | 3710 | 10 | 50 | 3710 | N/A | TDD | N/A |
|  | n1 | N/A | 5 | N/A | 2167.5 | 1.7 | FDD | IMD7Y |
|  | n7812 | 3305 | 10 | 1 (Rbstart=0) | 3305 | N/A | TDD | N/A |
|  |  | 3675 | 10 | 1 (Rbstart=44) | 3675 |  |  |  |
|  |  |  |  |  |  |  |  |  |
| NOTE 12: This band supports intra-band non-contiguous uplink configuration.  NOTE Y: For a UE which supports this band combination only when the Band n78 frequency range restriction of 3400 – 3800 MHz or 3300 – 3600 MHz applies, the MSD test point(s) cannot be verified for the band combination and the test point(s) can be skipped. | | | | | | | | |

For the non-contiguous uplink IMD interference analysis of the fallback and CA\_ n78(2a)-n102A with ULCA CA\_n78(2A) the analysis was completed in R4-2310355 of RAN4#107.

Table 5.55.2.1-4 lists Band n1 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n78, where Band n102C is the uplink band of the separated RB allocations and Band n1 is the contiguous single uplink carrier.

**Table 5.55.2.1-4: Band n1 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5945 | 6025 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 1920 | 1980 | 6405 | 6325 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 1760 | 1940 | 1960 | 2140 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 9890 | 10910 | 13790 | 14810 |  |  |

Table 5.55.2.1-5 lists Band n78 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n1, where Band n102C is the uplink band of the separated RB allocations and Band n78 is the contiguous single uplink carrier.

**Table 5.55.2.1-5: Band n78 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5965 | 6025 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 3300 | 3800 | 6385 | 6325 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 3140 | 3320 | 3780 | 3960 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 8070 | 9530 | 15170 | 16630 |  |  |

Based on Table 5.55.2.1-4, 1st order triple beat IMD has no occurrence in band n78. There is no change to the REFSENS requirements as there is no triple beat IMD.

Based on Table 5.55.2.1-5, 1st order triple beat IMD has no occurrence in band n1. There is no change to the REFSENS requirements as there is no triple beat IMD.

#### 5.55.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from DC\_8A\_n28-n79 are reused, for IMD5 into n102. This is the only combination that creates a 5th order IMD in the highest band, although 8A and n1 are distant in frequency, but so is n79 and n102. For IMD5 MSD 0.0dB could be used which is the same as for the case in DC\_8A\_n28-n79, which essentially asks for the test to prove that the UE is compliant with no relaxation despite the presence of the IMD product. However, given n102 is a shared spectrum access band the MSD is left as N/A.For IMD2 in band 1 the values of CA\_n1A-n41A-n79A are re-used for two higher bands generating IMD2 in band 1.

Table 5.55.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n78-n102 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n78 | 3320 | 5 | 25 | 3320 | N/A | TDD | N/A |
|  | n102 | 6020 | 40 | 216 | 6020 | N/A11 | TDD | IMD5 |
|  | n1 | 1965 | 5 | 25 | 2155 | 29.9 | FDD | IMD21 |
|  | n78 | 3790 | 5 | 25 | 3790 | N/A | TDD | N/A |
|  | n102 | 5945 | 40 | 216 | 5945 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 11: This is a share spectrum access band, hence no MSD is defined. | | | | | | | | |

## 5.56 CA\_n7-n78-n102

### 5.56.1 Common for 1 band UL and 2 bands UL CA

#### 5.56.1.1 Operating bands for CA

Table 5.56.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n78-n102 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
|  | n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
|  | n102 | 5925 MHz | – | 6425 MHz | 5925 MHz | – | 6425 MHz | TDD |

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

Table 5.56.1.2-1: Supported bandwidths per CA band combination of band n7+n78+n102

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n78A-n102A | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n78A-n102A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n7A-n78A-n102B | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n7A-n102B  CA\_n78A-n102A  CA\_n78A-n102B | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n7A-n78A-n102C | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n7A-n102C  CA\_n78A-n102A  CA\_n78A-n102C | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n7A-n78A-n102D | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n78A-n102A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n7A-n78A-n102E | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n78A-n102A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n7A-n78A-n102(2A) | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n78A-n102A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n7A-n78(2A)-n102A | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n7A-n78(2A)-n102B | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n7A-n102B  CA\_n78A-n102A  CA\_n78A-n102B  CA\_n78(2A) | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n7A-n78(2A)-n102C | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n7A-n102C  CA\_n78A-n102A  CA\_n78A-n102C  CA\_n78(2A) | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n7A-n78(2A)-n102D | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n7A-n78(2A)-n102E | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n7A-n78(2A)-n102(2A) | CA\_n7A-n78A  CA\_n7A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |

#### 5.56.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n78-n102, the ΔTIB,c and ΔRIB,c values are taken from fallbacks.

Table 5.56.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7-n78-n102 | 0.5 | 1.5 | 1.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.56.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7-n78-n102 | - | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.56.2 Specific for 2 bands UL CA

#### 5.56.2.1 UE co-existence studies

This is a 3-band combination, so uplink harmonic and harmonic mixing analysis is already done in the fallbacks. Only IMD for two uplink configurations is analysed.

Table 5.56.2.2-1 lists Band n7 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.56.2.2-2 lists Band n7 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.56.2.2-3 lists Band n78 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.56.2.1-1: Band n7 and Band n78 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 3300 | 3800 |
| DL Frequency [MHz] | 2620 | 2690 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 730 | 1300 | 5800 | 6370 |
| 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) | 1200 | 1840 | 4030 | 5100 |
| 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) | 8300 | 8940 | 9100 | 10170 |
| 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) | 3700 | 4410 | 7330 | 8900 |
| 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) | 2600 | 1460 | 11600 | 12740 |
| 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) | 10800 | 11510 | 12400 | 13970 |
| 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) | 12700 | 10630 | 6980 | 6200 |
| 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) | 6400 | 4760 | 1110 | 100 |
| 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) | 15700 | 17770 | 13300 | 14080 |
| 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) | 14900 | 16540 | 14100 | 15310 |

**Table 5.56.2.1-2: Band n7 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 5925 | 6425 |
| DL Frequency [MHz] | 2620 | 2690 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3355 | 3925 | 8425 | 8995 |
| 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) | 1425 | 785 | 9280 | 10350 |
| 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) | 10925 | 11565 | 14350 | 15420 |
| 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) | 1075 | 1785 | 15205 | 16775 |
| 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) | 7850 | 6710 | 16850 | 17990 |
| 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) | 13425 | 14135 | 20275 | 21845 |
| 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) | 23200 | 21130 | 4355 | 3575 |
| 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) | 14275 | 12635 | 4140 | 5350 |
| 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) | 26200 | 28270 | 15925 | 16705 |
| 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) | 22775 | 24415 | 19350 | 20560 |

**Table 5.56.2.1-3: Band n78 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3300 | 3800 | 5925 | 6425 |
| DL Frequency [MHz] | 3300 | 3800 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2125 | 3125 | 9225 | 10225 |
| 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) | 175 | 1675 | 8050 | 9550 |
| 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) | 12525 | 14025 | 15150 | 16650 |
| 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) | 3475 | 5475 | 13975 | 15975 |
| 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) | 6250 | 4250 | 18450 | 20450 |
| 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) | 15825 | 17825 | 21075 | 23075 |
| 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) | 22400 | 19900 | 9275 | 6775 |
| 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) | 12675 | 10175 | 450 | 2950 |
| 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) | 27000 | 29500 | 19125 | 21625 |
| 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) | 24375 | 26875 | 21750 | 24250 |

Based on the tables above it can be seen that

n7 + n78 IMD2 and IMD5 may affect Rx frequencies of band n102

n7 + n102 IMD2 and IMD5 may affect Rx frequencies of band n78

n78 + n102 IMD2 and IMD5 may affect Rx frequencies of band n7

The non-contiguous uplink IMD interference analysis has been completed in the fallbacks. For CA\_n7A-n78(2A) with ULCA CA\_n78(2A) the analysis was completed in R4-2220561 of RAN4#105 but missed in specification updates. The values are re-iterated below from R4-2220561:

Table 7.3A.5-1: 2DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations for PC3 CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n78 | n7 | N/A | 5 | N/A | 2687.5 | 15 | FDD | IMD5 |
|  | n7812 | 3405 | 10 | 1 (Rbstart=10) | 3405 | N/A | TDD | N/A |
|  |  | 3755 | 10 | 1 (Rbstart=0) | 3755 |  |  |  |
| NOTE 12: This band supports intra-band non-contiguous uplink configuration. | | | | | | | | |

For the non-contiguous uplink IMD interference analysis of the fallback and CA\_ n78(2a)-n102A with ULCA CA\_n78(2A) the analysis was completed in R4-2310355 of RAN4#107.

Table 5.56.2.1-4 lists Band n7 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n78, where Band n102C is the uplink band of the separated RB allocations and Band n7 is the contiguous single uplink carrier.

**Table 5.56.2.1-4: Band n7 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5965 | 6025 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 2500 | 2570 | 6385 | 6325 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 2340 | 2520 | 2550 | 2730 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 9300 | 10330 | 14370 | 15400 |  |  |

Table 5.56.2.1-5 lists Band n78 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n7, where Band n102C is the uplink band of the separated RB allocations and Band n78 is the contiguous single uplink carrier.

**Table 5.56.2.1-5: Band n78 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5965 | 6025 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 3300 | 3800 | 6385 | 6325 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 3140 | 3320 | 3780 | 3960 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 8070 | 9530 | 15170 | 16630 |  |  |

Based on Table 5.56.2.1-4. 1st order triple beat IMD has no occurrence in band n78. There is no change to the REFSENS requirements as there is no triple beat IMD.

Based on Table 5.56.2.1-5, 1st order triple beat IMD has no occurrence in band n7. There is no change to the REFSENS requirements as there is no triple beat IMD.

#### 5.56.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from DC\_7A-71A\_n78A are reused, for IMD2.

Table 5.56.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n78-n102 | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n78 | 3420 | 5 | 25 | 3420 | N/A | TDD | N/A |
|  | n102 | 5980 | 40 | 216 | 5980 | N/A11 | TDD | IMD21 |
|  | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n78 | 3420 | 5 | 25 | 3420 | 29.6 | TDD | IMD21 |
|  | n102 | 5980 | 40 | 216 | 5980 | N/A | TDD | N/A |
|  | n7 | 2560 | 5 | 25 | 2680 | 29.6 | FDD | IMD21 |
|  | n78 | 3320 | 5 | 25 | 3320 | N/A | TDD | N/A |
|  | n102 | 6000 | 40 | 216 | 6000 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 11: This is a share spectrum access band, hence no MSD is defined. | | | | | | | | |

## 5.57 CA\_n28-n78-n102

### 5.57.1 Common for 1 band UL and 2 bands UL CA

#### 5.57.1.1 Operating bands for CA

Table 5.57.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n28-n78-n102 | n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
|  | n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
|  | n102 | 5925 MHz | – | 6425 MHz | 5925 MHz | – | 6425 MHz | TDD |

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

Table 5.57.1.2-1: Supported bandwidths per CA band combination of band n28+n78+n102

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n28A-n78A-n102A | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n78A-n102A | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n28A-n78A-n102B | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n28A-n102B  CA\_n78A-n102A  CA\_n78A-n102B | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n28A-n78A-n102C | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n28A-n102C  CA\_n78A-n102A  CA\_n78A-n102C | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n28A-n78A-n102D | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n78A-n102A | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n28A-n78A-n102E | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n78A-n102A | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n28A-n78A-n102(2A) | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n78A-n102A | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n28A-n78(2A)-n102A | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n28A-n78(2A)-n102B | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n28A-n102B  CA\_n78A-n102A  CA\_n78A-n102B  CA\_n78(2A) | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n28A-n78(2A)-n102C | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n28A-n102C  CA\_n78A-n102A  CA\_n78A-n102C  CA\_n78(2A) | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n28A-n78(2A)-n102D | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n28A-n78(2A)-n102E | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n28A-n78(2A)-n102(2A) | CA\_n28A-n78A  CA\_n28A-n102A  CA\_n78A-n102A  CA\_n78(2A) | n28 | 5, 10, 15, 20 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |

#### 5.57.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n28-n78-n102, the ΔTIB,c and ΔRIB,c values are taken from fallbacks

Table 5.57.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n28-n78-n102 | 0.5 | 1.5 | 1.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.57.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n28-n78-n102 | 0.2 | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.57.2 Specific for 2 bands UL CA

#### 5.57.2.1 UE co-existence studies

This is a 3-band combination, so uplink harmonic and harmonic mixing analysis is already done in the fallbacks. Only IMD for two uplink configurations is analysed.

Table 5.57.2.2-1 lists Band n28 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.57.2.2-2 lists Band n28 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.57.2.2-3 lists Band n78 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.57.2.1-1: Band n28 and Band n78 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 703 | 748 | 3300 | 3800 |
| DL Frequency [MHz] | 758 | 803 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2552 | 3097 | 4003 | 4548 |
| 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) | 2394 | 1804 | 5852 | 6897 |
| 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) | 4706 | 5296 | 7303 | 8348 |
| 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) | 1691 | 1056 | 9152 | 10697 |
| 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) | 6194 | 5104 | 8006 | 9096 |
| 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) | 5409 | 6044 | 10603 | 12148 |
| 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) | 14497 | 12452 | 308 | 988 |
| 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) | 9994 | 8404 | 4356 | 5491 |
| 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) | 13903 | 15948 | 6112 | 6792 |
| 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) | 11306 | 12896 | 8709 | 9844 |

**Table 5.57.2.1-2: Band n28 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 703 | 748 | 5925 | 6425 |
| DL Frequency [MHz] | 758 | 803 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 5177 | 5722 | 6628 | 7173 |
| 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) | 5019 | 4429 | 11102 | 12147 |
| 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) | 7331 | 7921 | 12553 | 13598 |
| 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) | 4316 | 3681 | 17027 | 18572 |
| 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) | 11444 | 10354 | 13256 | 14346 |
| 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) | 8034 | 8669 | 18478 | 20023 |
| 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) | 24997 | 22952 | 2933 | 3613 |
| 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) | 17869 | 16279 | 9606 | 10741 |
| 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) | 24403 | 26448 | 8737 | 9417 |
| 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) | 19181 | 20771 | 13959 | 15094 |

**Table 5.57.2.1-3: Band n78 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3300 | 3800 | 5925 | 6425 |
| DL Frequency [MHz] | 3300 | 3800 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2125 | 3125 | 9225 | 10225 |
| 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) | 175 | 1675 | 8050 | 9550 |
| 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) | 12525 | 14025 | 15150 | 16650 |
| 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) | 3475 | 5475 | 13975 | 15975 |
| 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) | 6250 | 4250 | 18450 | 20450 |
| 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) | 15825 | 17825 | 21075 | 23075 |
| 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) | 22400 | 19900 | 9275 | 6775 |
| 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) | 12675 | 10175 | 450 | 2950 |
| 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) | 27000 | 29500 | 19125 | 21625 |
| 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) | 24375 | 26875 | 21750 | 24250 |

Based on the tables above it can be seen that

n28 + n78 IMD3, IMD4 and IMD5 may affect Rx frequencies of band n102

n28 + n102 IMD4 and IMD5 may affect Rx frequencies of band n78

n78 + n102 IMD3 and IMD5 may affect Rx frequencies of band n28

The non-contiguous uplink IMD interference analysis has been completed in the fallbacks. For CA\_n28A-n78(2A) with ULCA CA\_n78(2A) the analysis was completed in R4-2220561 of RAN4#105 but missed in specification updates. The analysis was though based on CA\_n28A-n77(2A) with ULCA CA\_n77(2A), but the MSD values for the analysis may be used for n78 as well. The values are re-iterated below from R4-2220561, but with uplink frequencies that comply with CA\_n28A\_n78(2A) frequency ranges:

Table 7.3A.5-1: 2DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations for PC3 CA

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n28-n78 | n28 | N/A | 5 | N/A | 780 | [8.6] | FDD | IMD4 |
|  | n7812 | 3320 | 10 | 1 (Rbstart=26) | 3320 | N/A | TDD | N/A |
|  |  | 3710 | 10 | 1 (Rbstart=26) | 3710 |  |  |  |
| NOTE 12: This band supports intra-band non-contiguous uplink configuration. | | | | | | | | |

For the non-contiguous uplink IMD interference analysis of the fallback and CA\_ n78(2a)-n102A with ULCA CA\_n78(2A) the analysis was completed in R4-2310355 of RAN4#107.

Table 5.57.2.1-4 lists Band n28 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n78, where Band n102C is the uplink band of the separated RB allocations and Band n28 is the contiguous single uplink carrier.

**Table 5.57.2.1-4: Band n28 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5965 | 6025 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 703 | 748 | 6385 | 6325 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 543 | 723 | 728 | 908 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 11122 | 12127 | 12573 | 13578 |  |  |

Table 5.57.2.1-5 lists Band n78 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n28, where Band n102C is the uplink band of the separated RB allocations and Band n78 is the contiguous single uplink carrier.

**Table 5.57.2.1-5: Band n78 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5965 | 6025 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 3300 | 3800 | 6385 | 6325 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 3140 | 3320 | 3780 | 3960 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 8070 | 9530 | 15170 | 16630 |  |  |

Based on Table 5.57.2.1-4, 1st order triple beat IMD has no occurrence in band n78. There is no change to the REFSENS requirements as there is no triple beat IMD.

Based on Table 5.57.2.1-5, 1st order triple beat IMD has no occurrence in band n28. There is no change to the REFSENS requirements as there is no triple beat IMD.

#### 5.57.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from CA\_n28-n46-n78 are reused, for IMD3 for n102 and n28. MSD values from CA\_n41-n71-n78 MSD values from CA\_n28-n46-n78 are reused, for IMD3 for n102 and n28. MSD values from CA\_n41-n71-n78are reused, for IMD4 for n78.

Table 5.57.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n28-n78-n102 | n28 | 710 | 5 | 25 | 765 | N/A | FDD | N/A |
|  | n78 | 3380 | 5 | 25 | 3380 | N/A | TDD | N/A |
|  | n102 | 6050 | 40 | 216 | 6050 | 22 | TDD | IMD31,2 |
|  | n28 | 730 | 5 | 25 | 785 | N/A | FDD | N/A |
|  | n78 | 3755 | 5 | 25 | 3755 | 10.3 | TDD | IMD41 |
|  | n102 | 5945 | 40 | 216 | 5945 | N/A | TDD | N/A |
|  | n28 | 720 | 5 | 25 | 775 | 16 | FDD | IMD31,2 |
|  | n78 | 3395 | 5 | 25 | 3395 | N/A | TDD | N/A |
|  | n102 | 6015 | 40 | 216 | 6015 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.58 CA\_n1-n3-n105

### 5.58.1 Common for 1 band UL and 2 bands UL CA

#### 5.58.1.1 Operating bands for CA

Table 5.58.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n3-n105 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.58.1.2-1: Supported bandwidths per CA band combination of band n1+n3+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n3A-n105A | CA\_n1A-n3A  CA\_n1A-n105A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n3A-n105A | n3 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.58.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n3-n105, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n3-n5 and are given in the tables below.

Table 5.58.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1A-n3A-n105A | 0.3 | 0.3 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.58.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1A-n3A-n105A | 0.3 | 0.3 | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.58.2 Specific for 2 bands UL CA

#### 5.58.2.1 UE co-existence studies

Table 5.58.2.1-1 lists Band n1 + Band n3 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.58.2.1-2 lists Band n1 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.58.2.1-3 lists Band n3 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.58.2.1-1: Band n1 and Band n3 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 1710 | 1785 |
| DL Frequency [MHz] | 2110 | 2170 | 1805 | 1880 |
| 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 |
| 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 |
| 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 | |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 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 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 |

**Table 5.58.2.1-2: Band n1 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 663 | 703 |
| DL Frequency [MHz] | 2110 | 2170 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 | 1217 | 2583 | 2683 |
| 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) | 3137 | 3297 | 654 | 514 |
| 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) | 4503 | 4663 | 3246 | 3386 |
| 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) | 5057 | 5277 | 9 | 189 |
| 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) | 2434 | 2634 | 5166 | 5366 |
| 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) | 6423 | 6643 | 3909 | 4089 |
| 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) | 892 | 672 | 7257 | 6977 |
| 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) | 1731 | 1971 | 4614 | 4354 |
| 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) | 4572 | 4792 | 8343 | 8623 |
| 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) | 5829 | 6069 | 7086 | 7346 |

**Table 5.58.2.1-3: Band n3 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 663 | 703 |
| DL Frequency [MHz] | 1805 | 1880 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 | 1007 | 2373 | 2488 |
| 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) | 2717 | 2907 | 459 | 304 |
| 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) | 4083 | 4273 | 3036 | 3191 |
| 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) | 4427 | 4692 | 204 | 399 |
| 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) | 2014 | 2244 | 4746 | 4976 |
| 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) | 5793 | 6058 | 3699 | 3894 |
| 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) | 1102 | 867 | 6477 | 6137 |
| 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) | 1311 | 1581 | 4029 | 3724 |
| 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) | 4362 | 4597 | 7503 | 7843 |
| 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) | 5409 | 5679 | 6456 | 6761 |

Based on the tables above it can be seen that

n1 + n105 IMD5 may affect Rx frequencies of band n3

n3 + n105 IMD4 may affect Rx frequencies of band n1.

#### 5.58.2.2 REFSENS requirements

MSD values are reused from DC\_1A-3A\_n71A and DC\_1A-3A\_n28A.

**Table 5.58.2.2-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n3-n105 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n3 | 1760 | 5 | 25 | 1855 | 4 | FDD | IMD5 |
|  | n105 | 695 | 5 | 25 | 644 | N/A | FDD | N/A |
|  | n1 | 1970 | 5 | 25 | 2160 | 5 | FDD | IMD4 |
|  | n3 | 1775 | 5 | 25 | 1870 | N/A | FDD | N/A |
|  | n105 | 695 | 5 | 25 | 644 | N/A | FDD | N/A |

## 5.59 CA\_n1-n40-n105

### 5.59.1 Common for 1 band UL and 2 bands UL CA

#### 5.59.1.1 Operating bands for CA

Table 5.59.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n40-n105 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.59.1.2-1: Supported bandwidths per CA band combination of band n1+n40+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n40A-n105A | CA\_n1A-n40A  CA\_n1A-n105A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n40A-n105A | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.59.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n40-n105, the ΔTIB,c and ΔRIB,c values are taken from fallbacks.

Table 5.59.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1A-n40A-n105A | 0.5 | 0.5 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.59.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1A-n40A-n105A | - | - | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.59.2 Specific for 2 bands UL CA

#### 5.59.2.1 UE co-existence studies

Table 5.59.2.1-1 lists Band n1 + Band n40 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.59.2.1-2 lists Band n1 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.59.2.1-3 lists Band n40 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.59.2.1-1: Band n1 and Band n40 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 2300 | 2400 |
| DL Frequency [MHz] | 2110 | 2170 | 2300 | 2400 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 320 | 480 | 4220 | 4380 |
| 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) | 1440 | 1660 | 2620 | 2880 |
| 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) | 6140 | 6360 | 6520 | 6780 |
| 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) | 3360 | 3640 | 4920 | 5280 |
| 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) | 960 | 640 | 8440 | 8760 |
| 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) | 8060 | 8340 | 8820 | 9180 |
| 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) | 7680 | 7220 | 5620 | 5280 |
| 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) | 3360 | 2940 | 1340 | 960 |
| 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) | 11120 | 11580 | 9980 | 10320 |
| 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) | 10740 | 11160 | 10360 | 10740 |

**Table 5.59.2.1-2: Band n1 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 663 | 703 |
| DL Frequency [MHz] | 2110 | 2170 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 | 1217 | 2583 | 2683 |
| 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) | 3137 | 3297 | 654 | 514 |
| 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) | 4503 | 4663 | 3246 | 3386 |
| 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) | 5057 | 5277 | 9 | 189 |
| 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) | 2434 | 2634 | 5166 | 5366 |
| 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) | 6423 | 6643 | 3909 | 4089 |
| 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) | 892 | 672 | 7257 | 6977 |
| 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) | 1731 | 1971 | 4614 | 4354 |
| 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) | 4572 | 4792 | 8343 | 8623 |
| 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) | 5829 | 6069 | 7086 | 7346 |

**Table 5.59.2.1-3: Band n40 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2300 | 2400 | 663 | 703 |
| DL Frequency [MHz] | 2300 | 2400 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1737 | 1597 | 2963 | 3103 |
| 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) | 3897 | 4137 | 1074 | 894 |
| 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) | 5263 | 5503 | 3626 | 3806 |
| 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) | 6197 | 6537 | 411 | 191 |
| 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) | 3194 | 3474 | 5926 | 6206 |
| 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) | 7563 | 7903 | 4289 | 4509 |
| 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) | 512 | 252 | 8937 | 8497 |
| 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) | 2491 | 2811 | 5874 | 5494 |
| 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) | 4952 | 5212 | 9863 | 10303 |
| 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) | 6589 | 6909 | 8226 | 8606 |

Based on the tables above it can be seen that

* n1 + n40 IMD4 may affect Rx frequencies of band n105

#### 5.59.2.2 REFSENS requirements

MSD values for this case depends on the test points. It is not possible to select frequency points that combine to a direct hit in the victim RX band, but the 4th order IMD product will cover the highest channel of the RX victim band.

**Table 5.59.2.2-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n40-n105 | n1 | 1977 | 5 | 25 | 2167 | N/A | FDD | N/A |
|  | n40 | 2305 | 10 | 50 | 2305 | N/A | TDD | N/A |
|  | n105 | 700 | 5 | 25 | 649 | 1dB | FDD | IMD4 |

## 5.60 CA\_n1-n78-n105

### 5.60.1 Common for 1 band UL and 2 bands UL CA

#### 5.60.1.1 Operating bands for CA

Table 5.60.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n78-n105 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.60.1.2-1: Supported bandwidths per CA band combination of band n1+n78+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n78A-n105A | CA\_n1A-n78A  CA\_n1A-n105A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n78A-n105A | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.60.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n78-n105, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n28-n78 and are given in the tables below.

Table 5.60.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1A-n78A-n105A | 0.3 | 0.8 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.60.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1A-n78A-n105A | - | 0.5 | 0.2 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.60.2 Specific for 2 bands UL CA

#### 5.60.2.1 UE co-existence studies

Table 5.x.2.1-1 lists Band n1 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.x.2.1-2 lists Band n1 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.x.2.1-3 lists Band n78 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.60.2.1-1: Band n1 and Band n78 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 3300 | 3800 |
| DL Frequency [MHz] | 2110 | 2170 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1320 | 1880 | 5220 | 5780 |
| 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) | 40 | 660 | 4620 | 5680 |
| 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) | 7140 | 7760 | 8520 | 9580 |
| 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) | 1960 | 2640 | 7920 | 9480 |
| 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) | 3760 | 2640 | 10440 | 11560 |
| 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) | 9060 | 9740 | 11820 | 13380 |
| 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) | 13280 | 11220 | 4620 | 3880 |
| 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) | 7560 | 5940 | 660 | 1840 |
| 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) | 15120 | 17180 | 10980 | 11720 |
| 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) | 13740 | 15360 | 12360 | 13540 |

**Table 5.60.2.1-2: Band n1 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 663 | 703 |
| DL Frequency [MHz] | 2110 | 2170 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 | 1217 | 2583 | 2683 |
| 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) | 3137 | 3297 | 654 | 514 |
| 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) | 4503 | 4663 | 3246 | 3386 |
| 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) | 5057 | 5277 | 9 | 189 |
| 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) | 2434 | 2634 | 5166 | 5366 |
| 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) | 6423 | 6643 | 3909 | 4089 |
| 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) | 892 | 672 | 7257 | 6977 |
| 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) | 1731 | 1971 | 4614 | 4354 |
| 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) | 4572 | 4792 | 8343 | 8623 |
| 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) | 5829 | 6069 | 7086 | 7346 |

**Table 5.60.2.1-3: Band n78 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3300 | 3800 | 663 | 703 |
| DL Frequency [MHz] | 3300 | 3800 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3137 | 2597 | 3963 | 4503 |
| 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) | 5897 | 6937 | 2474 | 1894 |
| 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) | 7263 | 8303 | 4626 | 5206 |
| 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) | 9197 | 10737 | 1811 | 1191 |
| 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) | 5194 | 6274 | 7926 | 9006 |
| 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) | 10563 | 12103 | 5289 | 5909 |
| 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) | 488 | 1148 | 14537 | 12497 |
| 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) | 4491 | 5611 | 10074 | 8494 |
| 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) | 5952 | 6612 | 13863 | 15903 |
| 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) | 8589 | 9709 | 11226 | 12806 |

Based on the tables above it can be seen that

n1 + n78 IMD3 may affect Rx frequencies of band n105

n1 + n105 IMD3 may affect Rx frequencies of band n78

n78 + n105 IMD3 may affect Rx frequencies of band n1

#### 5.60.2.2 REFSENS requirements

MSD values have been re-used from DC\_1A-28A\_n78A, DC\_1A\_n28A-n78A and DC\_1A-28A\_n79A.

**Table 5.60.2.2-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n78-n105 | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n78 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
|  | n105 | 686 | 5 | 25 | 635 | 15.2 | FDD | IMD3 |
|  | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n78 | 3342 | 10 | 50 | 3342 | 15.7 | TDD | IMD3 |
|  | n105 | 686 | 5 | 25 | 635 | N/A | FDD | N/A |
|  | n1 | 1970 | 5 | 25 | 2160 | 15.7 | FDD | IMD3 |
|  | n78 | 3532 | 10 | 50 | 3532 | N/A | TDD | N/A |
|  | n105 | 686 | 5 | 25 | 635 | N/A | FDD | N/A |

## 5.61 CA\_n3-n40-n105

### 5.61.1 Common for 1 band UL and 2 bands UL CA

#### 5.61.1.1 Operating bands for CA

Table 5.61.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n40-n105 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.61.1.2-1: Supported bandwidths per CA band combination of band n3+n40+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n40A-n105A | CA\_n3A-n40A  CA\_n3A-n105A | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n40A-n105A | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.61.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n40-n105, the ΔTIB,c and ΔRIB,c values are taken from the fallbacks.

Table 5.61.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3A-n40A-n105A | 0.5 | 0.5 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.61.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3A-n40A-n105A | - | - | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.61.2 Specific for 2 bands UL CA

#### 5.61.2.1 UE co-existence studies

Table 5.61.2.1-1 lists Band n3 + Band n40 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.61.2.1-2 lists Band n3 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.61.2.1-3 lists Band n40 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.61.2.1-1: Band n3 and Band n40 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 2300 | 2400 |
| DL Frequency [MHz] | 1805 | 1880 | 2300 | 2400 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 515 | 690 | 4010 | 4185 |
| 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) | 1020 | 1270 | 2815 | 3090 |
| 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) | 5720 | 5970 | 6310 | 6585 |
| 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) | 2730 | 3055 | 5115 | 5490 |
| 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) | 1380 | 1030 | 8020 | 8370 |
| 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) | 7430 | 7755 | 8610 | 8985 |
| 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) | 7890 | 7415 | 4840 | 4440 |
| 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) | 3780 | 3330 | 755 | 330 |
| 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) | 10910 | 11385 | 9140 | 9540 |
| 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) | 10320 | 10770 | 9730 | 10155 |

**Table 5.61.2.1-2: Band n3 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 663 | 703 |
| DL Frequency [MHz] | 1805 | 1880 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 | 1007 | 2373 | 2488 |
| 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) | 2717 | 2907 | 459 | 304 |
| 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) | 4083 | 4273 | 3036 | 3191 |
| 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) | 4427 | 4692 | 204 | 399 |
| 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) | 2014 | 2244 | 4746 | 4976 |
| 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) | 5793 | 6058 | 3699 | 3894 |
| 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) | 1102 | 867 | 6477 | 6137 |
| 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) | 1311 | 1581 | 4029 | 3724 |
| 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) | 4362 | 4597 | 7503 | 7843 |
| 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) | 5409 | 5679 | 6456 | 6761 |

**Table 5.x.2.1-3: Band n40 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2300 | 2400 | 663 | 703 |
| DL Frequency [MHz] | 2300 | 2400 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1737 | 1597 | 2963 | 3103 |
| 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) | 3897 | 4137 | 1074 | 894 |
| 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) | 5263 | 5503 | 3626 | 3806 |
| 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) | 6197 | 6537 | 411 | 191 |
| 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) | 3194 | 3474 | 5926 | 6206 |
| 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) | 7563 | 7903 | 4289 | 4509 |
| 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) | 512 | 252 | 8937 | 8497 |
| 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) | 2491 | 2811 | 5874 | 5494 |
| 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) | 4952 | 5212 | 9863 | 10303 |
| 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) | 6589 | 6909 | 8226 | 8606 |

Based on the tables above it can be seen that

n3 + n40 IMD2 and IMD5 may affect Rx frequencies of band n105

n3 + n105 IMD2 may affect Rx frequencies of band n40

#### 5.61.2.2 REFSENS requirements

MSD values are re-used from DC\_3-28\_n41 that has similar kind of IMD2 and IMD5 cases.

**Table 5.61.2.2-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n40-n105 | n3 | 1745 | 5 | 25 | 1840 | N/A | FDD | N/A |
|  | n40 | 2380 | 10 | 50 | 2380 | N/A | TDD | N/A |
|  | n105 | 686 | 5 | 25 | 635 | 26.0 | FDD | IMD24 |
|  | n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
|  | n40 | 2388 | 10 | 50 | 2388 | 26.0 | TDD | IMD2 |
|  | n105 | 668 | 5 | 25 | 617 | N/A | FDD | N/A |
| NOTE 4: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.62 CA\_n3-n78-n105

### 5.62.1 Common for 1 band UL and 2 bands UL CA

#### 5.62.1.1 Operating bands for CA

Table 5.62.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n78-n105 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.62.1.2-1: Supported bandwidths per CA band combination of band n3+n78+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n78A-n105A | CA\_n3A-n78A  CA\_n3A-n105A | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n78A-n105A | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.62.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n78-n105, the ΔTIB,c and ΔRIB,c values are reused from DC\_3-28\_n78 and are given in the tables below.

Table 5.62.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3A-n78A-n105A | 0.6 | 0.8 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.62.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3A-n78A-n105A | 0.2 | 0.5 | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.62.2 Specific for 2 bands UL CA

#### 5.62.2.1 UE co-existence studies

Table 5.62.2.1-1 lists Band n3 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.62.2.1-2 lists Band n3 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.62.2.1-3 lists Band n78 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.62.2.1-1: Band n3 and Band n78 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 3300 | 3800 |
| DL Frequency [MHz] | 1805 | 1880 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515 | 2090 | 5010 | 5585 |
| 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) | 380 | 270 | 4815 | 5890 |
| 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) | 6720 | 7370 | 8310 | 9385 |
| 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) | 1330 | 2055 | 8115 | 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) | 4180 | 3030 | 10020 | 11170 |
| 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) | 8430 | 9155 | 11610 | 13185 |
| 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) | 13490 | 11415 | 3840 | 3040 |
| 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) | 7980 | 6330 | 1245 | 2470 |
| 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) | 14910 | 16985 | 10140 | 10940 |
| 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) | 13320 | 14970 | 11730 | 12955 |

**Table 5.62.2.1-2: Band n3 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 663 | 703 |
| DL Frequency [MHz] | 1805 | 1880 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 | 1007 | 2373 | 2488 |
| 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) | 2717 | 2907 | 459 | 304 |
| 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) | 4083 | 4273 | 3036 | 3191 |
| 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) | 4427 | 4692 | 204 | 399 |
| 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) | 2014 | 2244 | 4746 | 4976 |
| 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) | 5793 | 6058 | 3699 | 3894 |
| 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) | 1102 | 867 | 6477 | 6137 |
| 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) | 1311 | 1581 | 4029 | 3724 |
| 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) | 4362 | 4597 | 7503 | 7843 |
| 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) | 5409 | 5679 | 6456 | 6761 |

**Table 5.62.2.1-3: Band n78 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3300 | 3800 | 663 | 703 |
| DL Frequency [MHz] | 3300 | 3800 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3137 | 2597 | 3963 | 4503 |
| 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) | 5897 | 6937 | 2474 | 1894 |
| 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) | 7263 | 8303 | 4626 | 5206 |
| 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) | 9197 | 10737 | 1811 | 1191 |
| 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) | 5194 | 6274 | 7926 | 9006 |
| 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) | 10563 | 12103 | 5289 | 5909 |
| 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) | 488 | 1148 | 14537 | 12497 |
| 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) | 4491 | 5611 | 10074 | 8494 |
| 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) | 5952 | 6612 | 13863 | 15903 |
| 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) | 8589 | 9709 | 11226 | 12806 |

Based on the tables above it can be seen that

n3 + n105 IMD4 and IMD5 may affect Rx frequencies of band n78

n78 + n105 IMD4 may affect Rx frequencies of band n3

#### 5.62.2.2 REFSENS requirements

MSD values have been re-used from DC\_3A-28A\_n78A for RX band n78.

For the IMD4 case hitting n3 it depends on the test points. It is not possible to select frequency points that combine to a direct hit in the victim RX band. It is therefore omitted (3795MHz – 3\*666MHz = 1797MHz, which is 11MHz below the centre frequency of the lowest n3 DL channel)

**Table 5.62.2.2-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n78-n105 | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n78 | 3740 | 10 | 50 | 3740 | 17.3 | TDD | IMD44 |
|  | n105 | 670 | 5 | 25 | 619 | N/A | FDD | N/A |

## 5.63 CA\_n40-n78-n105

### 5.63.1 Common for 1 band UL and 2 bands UL CA

#### 5.63.1.1 Operating bands for CA

Table 5.63.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n40-n78-n105 | n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.63.1.2-1: Supported bandwidths per CA band combination of band n40+n78+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n40A-n78A-n105A | CA\_n40A-n78A  CA\_n40A-n105A | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | 0 |
|  | CA\_n78A-n105A | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.63.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n40-n78-n105, the ΔTIB,c and ΔRIB,c values are reused from DC\_28\_n40-n78 and are given in the tables below.

Table 5.63.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n40A-n78A-n105A | 0.3 | 0.8 | 0.5 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.63.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n40A-n78A-n105A | 0.4 | 0.5 | 0.2 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.63.2 Specific for 2 bands UL CA

#### 5.63.2.1 UE co-existence studies

Table 5.63.2.1-1 lists Band n40 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.63.2.1-2 lists Band n40 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.63.2.1-3 lists Band n78 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.63.2.1-1: Band n40 and Band n78 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2300 | 2400 | 3300 | 3800 |
| DL Frequency [MHz] | 2300 | 2400 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 900 | 1500 | 5600 | 6200 |
| 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) | 800 | 1500 | 4200 | 5300 |
| 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) | 7900 | 8600 | 8900 | 10000 |
| 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) | 3100 | 3900 | 7500 | 9100 |
| 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) | 3000 | 1800 | 11200 | 12400 |
| 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) | 10200 | 11000 | 12200 | 13800 |
| 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) | 12900 | 10800 | 6300 | 5400 |
| 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) | 6800 | 5100 | 600 | 700 |
| 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) | 15500 | 17600 | 12500 | 13400 |
| 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) | 14500 | 16200 | 13500 | 14800 |

**Table 5.63.2.1-2: Band n40 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | 2300 | 2400 | 663 | 703 |
| UL Frequency [MHz] | 2300 | 2400 | 612 | 652 |
| DL Frequency [MHz] | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| 2nd order IMD products | 1737 | 1597 | 2963 | 3103 |
| IMD frequency limits (MHz) | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| 3rd order IMD products | 3897 | 4137 | 1074 | 894 |
| IMD frequency limits (MHz) | |2\*fx\_low + fy\_low| | |2\*fx\_high + fy\_high| | |2\*fy\_low + fx\_low| | |2\*fy\_high + fx\_high| |
| 3rd order IMD products | 5263 | 5503 | 3626 | 3806 |
| IMD frequency limits (MHz) | |3\*fx\_low –1\* fy\_high| | |3\*fx\_high – 1\*fy\_low| | |3\*fy\_low – 1\*fx\_high| | |3\*fy\_high – 1\*fx\_low| |
| Two-tone 4th order IMD products | 6197 | 6537 | 411 | 191 |
| IMD frequency limits (MHz) | |2\*fx\_low –2\* fy\_high| | |2\*fx\_high –2\* fy\_low| | |2\*fx\_low +2\* fy\_low| | |2\*fx\_high +2\* fy\_high| |
| Two-tone 4th order IMD products | 3194 | 3474 | 5926 | 6206 |
| IMD frequency limits (MHz) | |3\*fx\_low +1\* fy\_low| | |3\*fx\_high + 1\*fy\_high| | |3\*fy\_low + 1\*fx\_low| | |3\*fy\_high + 1\*fx\_high| |
| Two-tone 4th order IMD products | 7563 | 7903 | 4289 | 4509 |
| IMD frequency limits (MHz) | |fx\_low – 4\*fy\_high| | |fx\_high – 4\*fy\_low| | |fy\_low – 4\*fx\_high| | |fy\_high – 4\*fx\_low| |
| Two-tone 5th order IMD products | 512 | 252 | 8937 | 8497 |
| IMD frequency limits (MHz) | |2\*fx\_low – 3\*fy\_high| | |2\*fx\_high – 3\*fy\_low| | |2\*fy\_low – 3\*fx\_high| | |2\*fy\_high -3\*fx\_low| |
| Two-tone 5th order IMD products | 2491 | 2811 | 5874 | 5494 |
| IMD frequency limits (MHz) | |fx\_low + 4\*fy\_low| | |fx\_high + 4\*fy\_high| | |fy\_low + 4\*fx\_low| | |fy\_high + 4\*fx\_high| |
| Two-tone 5th order IMD products | 4952 | 5212 | 9863 | 10303 |
| IMD frequency limits (MHz) | |2\*fx\_low + 3\*fy\_low| | |2\*fx\_high + 3\*fy\_high| | |2\*fy\_low + 3\*fx\_low| | |2\*fy\_high + 3\*fx\_high| |
| Two-tone 5th order IMD products | 6589 | 6909 | 8226 | 8606 |
| IMD frequency limits (MHz) | 2300 | 2400 | 663 | 703 |

**Table 5.63.2.1-3: Band n78 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3300 | 3800 | 663 | 703 |
| DL Frequency [MHz] | 3300 | 3800 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3137 | 2597 | 3963 | 4503 |
| 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) | 5897 | 6937 | 2474 | 1894 |
| 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) | 7263 | 8303 | 4626 | 5206 |
| 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) | 9197 | 10737 | 1811 | 1191 |
| 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) | 5194 | 6274 | 7926 | 9006 |
| 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) | 10563 | 12103 | 5289 | 5909 |
| 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) | 488 | 1148 | 14537 | 12497 |
| 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) | 4491 | 5611 | 10074 | 8494 |
| 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) | 5952 | 6612 | 13863 | 15903 |
| 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) | 8589 | 9709 | 11226 | 12806 |

Based on the tables above it can be seen that

n40 + n78 IMD5 may affect Rx frequencies of band n105

n40+ n105 IMD3 and IMD4 may affect Rx frequencies of band n78

n78 + n105 IMD3 may affect Rx frequencies of band n40

#### 5.63.2.2 REFSENS requirements

MSD values have been re-used from CA\_n28-n40-n78 and DC\_28A-40A\_n78A. For the IMD5 MSD value similar cases of IMD5 was studied like DC\_5-7\_n78 and DC\_18-41\_n78.

**Table 5.63.2.2-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n40-n78-n105 | n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
|  | n78 | 3789 | 10 | 50 | 3789 | N/A | TDD | N/A |
|  | n105 | 699 | 5 | 25 | 648 | 3.3 | FDD | IMD5 |
|  | n40 | 2310 | 5 | 25 | 2310 | N/A | TDD | N/A |
|  | n78 | 3708 | 10 | 50 | 3708 | 16 | TDD | IMD3 |
|  | n105 | 699 | 5 | 25 | 648 | N/A | FDD | N/A |
|  | n40 | 2310 | 5 | 25 | 2310 | 15.7 | TDD | IMD3 |
|  | n78 | 3708 | 10 | 50 | 3708 | N/A | TDD | N/A |
|  | n105 | 699 | 5 | 25 | 648 | N/A | FDD | N/A |

## 5.64 CA\_n5-n41-n66

### 5.64.1 Common for 1 band UL and 2 bands UL CA

#### 5.64.1.1 Operating bands for CA

Table 5.64.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n41-n66 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.64.1.2-1: Supported bandwidths per CA band combination of band n5+n41+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n41A-n66A | CA\_n5A-n41A  CA\_n5A-n66A CA\_n41A-n66A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n41 | 10, 15, 20 30, 40, 50, 60, 80, 90, 100 |  |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 35, 40, 45 |  |

#### 5.64.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5-n41-n66, the ΔTIB,c and ΔRIB,c values are reused from DC\_5-7\_n66 and are given in the tables below.

Table 5.64.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n41-n66 | 0.6 | 0.85 / 1.36 | 0.5 |
| NOTE 5: The requirement is applied for UE transmitting on the frequency range of 2545 – 2690 MHz.  NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2496 – 2545 MHz  NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.64.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n41-n66 | 0.2 | 0.55 / 16 | 0.5 |
| NOTE 5: The requirement is applied for UE transmitting on the frequency range of 2545 – 2690 MHz.  NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2496 – 2545 MHz.  NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.64.2 Specific for 2 bands UL CA

#### 5.64.2.1 UE co-existence studies

Co-existence studies shows that:

IMD2 and IMD3 caused by UL CA\_n5-n66 Tx may fall into band n41 Rx.

IMD2 and IMD3 caused by UL CA\_n41-n66 Tx may fall into band n5 Rx.

#### 5.64.2.2 REFSENS requirements

For the IMD2 into band n41, the MSD values is reused from DC\_5-7\_n66 and are defined in table 5.64.2.2-1.

For the IMD2 into band n5, the MSD values is reused from CA\_n3-n18-n41 and are defined in table 5.64.2.2-1.

Table 5.64.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n5-n41-n66 | n5 | 846.5 | 5 | 25 | 891.5 | N/A | FDD | N/A |
|  | n41 | 2624 | 10 | 50 | 2624 | 29.0 | TDD | IMD24 |
|  | n66 | 1777.5 | 5 | 25 | 2177.5 | N/A | FDD | N/A |
|  | n5 | 830 | 5 | 25 | 875 | 28.9 | FDD | IMD24 |
|  | n41 | 2640 | 10 | 50 | 2640 | N/A | TDD | N/A |
|  | n66 | 1765 | 5 | 25 | 2165 | N/A | FDD | N/A |
| NOTE 4: This band is subject to IMD3 also which MSD is not specified. | | | | | | | | |

## 5.65 CA\_n2-n5-n41

### 5.65.1 Common for 1 band UL and 2 bands UL CA

#### 5.65.1.1 Operating bands for CA

Table 5.65.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n2-n5-n41 | n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |

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

Table 5.65.1.2-1: Supported bandwidths per CA band combination of band n2+n5+n41

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n2A-n5A-n41A | CA\_n2A\_n5A  CA\_n2A\_n41A  CA\_n5A\_n41A | n2 | 5, 10, 15, 20, 25, 30, 35, 40 | 0 |
|  |  | n5 | 5, 10, 15, 20, 25 |  |
|  |  | n41 | 10, 15, 20 30, 40, 50, 60, 80, 90, 100 |  |

#### 5.65.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n2-n5-n41, the ΔTIB,c and ΔRIB,c values are reused from DC\_2-5\_n7 and are given in the tables below.

Table 5.65.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n2-n5-n41 | 0.5 | 0.6 | 0.45 / 0.96 |
| NOTE 5: The requirement is applied for UE transmitting on the frequency range of 2545 – 2690 MHz.  NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2496 – 2545 MHz.  NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.65.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n2-n5-n41 | - | 0.2 | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.65.2 Specific for 2 bands UL CA

#### 5.65.2.1 UE co-existence studies

Co-existence studies shows that IMD2 caused by UL CA\_n2-n5 Tx may fall into band n41 Rx.

#### 5.65.2.2 REFSENS requirements

For the IMD2 into band n41, the MSD values is reused from DC\_2A-7A\_n5A and are defined in table 5.65.2.2-1:

Table 5.65.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n2-n5-n41 | n2 | 1855 | 10 | 50 | 1935 | N/A | FDD | N/A |
|  | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n41 | 2685 | 10 | 50 | 2685 | 30.0 | TDD | IMD2 |

## 5.66 CA\_n29-n66-n71

### 5.66.1 Common for 1 band UL and 2 bands UL CA

#### 5.66.1.1 Operating bands for CA

Table 5.66.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n29-n66-n71 | n29 | N/A | – | N/A | 717 MHz | – | 728 MHz | SDL |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.66.1.2-1: Supported bandwidths per CA band combination of band n29+n66+n71

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n29A-n66A-n71A | CA\_n66A-n71A | n29 | 5, 10 | 0 |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n71 | 5, 10, 15, 20 |  |
| CA\_n29A-n66(2A)-n71A | CA\_n66A-n71A | n29 | 5, 10 | 0 |
|  |  | n66 | CA\_n66(2A)\_BCS1 |  |
|  |  | n71 | 5, 10, 15, 20 |  |

#### 5.66.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n29-n66-n71, the ΔTIB,c and ΔRIB,c values are given in the tables below.

**Table 5.66.1.3-1: ΔTIB,c**

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n29-n66-n71 | - | 0.3 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

**Table 5.66.1.3-2: ΔRIB,c**

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n29-n66-n71 | 0.5 | 0.3 | 0.7 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.66.2 Specific for 2 bands UL CA

#### 5.66.2.1 UE co-existence studies

Table 5.66.2.2-1 lists Band n66 + Band n71 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.66.2.2-1: Band n66 and Band n71 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequencies (MHz) | 1710 | 1780 | 663 | 698 |
| 2nd order IMD products | |fx\_low – fy\_high| | |fx\_high – fy\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1012 | 1117 | 2373 | 2478 |
| 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) | 2722 | 2897 | 314 | 454 |
| 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) | 4083 | 4258 | 3036 | 3176 |
| 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) | 4432 | 4677 | 209 | 384 |
| 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) | 5793 | 6038 | 3699 | 3874 |
| 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) | 2024 | 2234 | 4746 | 4956 |
| 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) | 872 | 1082 | 6142 | 6457 |
| 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) | 4362 | 4572 | 7503 | 7818 |
| 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) | 1326 | 1571 | 3734 | 4014 |
| 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) | 5409 | 5654 | 6456 | 6736 |

Based on the table above it can be seen that there is no n66 + n71 IMD may affect Rx frequencies of band n29.

#### 5.66.2.2 REFSENS requirements

Based on co-existence studies on 5.66.2.1, no need to define exceptional REFSENS requirements.

## 5.67 CA\_n8-n41-n79

### 5.67.1 Common for 1 band UL and 2 bands UL CA

#### 5.67.1.1 Operating bands for CA

Table 5.67.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| n8A-n41A-n79A | n8, n41, n79 |

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

Table 5.67.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n8A-n41A-n79A | CA\_n8A-n41A  CA\_n8A-n79A  CA\_n41A-n79A | n8 | See n8 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | See n41 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |

#### 5.67.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n8-n41-n79, the ΔTIB,c and ΔRIB,c values have already been defined in the spec.

### 5.67.2 Specific for 2 bands UL CA

#### 5.67.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n8A-n41A, CA\_n8A-n79A and CA\_n41A-n79A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD3 issue caused by n8+n41 fall into the its own band n79 Rx;

IMD3 and 5 issue caused by n41+n79 fall into the its own band n8 Rx;

IMD3 issue caused by n8+n79 fall into the its own band n41 Rx.

#### 5.67.2.2 REFSENS requirements

Based on co-existence studies additional MSD are needed to be defined, shown in table 5.67.2.2-1. Where some MSD requirements are reused form DC\_8\_n41-n79.

Table 5.67.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplexer Mode | IMD order |
| CA\_n8-n41-n79 | n8 | 910 | 5 | 25 | 955 | N/A | FDD | N/A |
|  | n41 | 2650 | 10 | 50 | 2650 | N/A | TDD | N/A |
|  | n79 | 4470 | 10 | 50 | 4470 | 16.3 | TDD | IMD3 |
|  | n8 | 910 | 5 | 25 | 955 | N/A | FDD | N/A |
|  | n41 | 2650 | 10 | 50 | 2650 | 15.5 | TDD | IMD3 |
|  | n79 | 4470 | 10 | 50 | 4470 | N/A | TDD | N/A |
|  | n8 | 895 | 5 | 25 | 940 | 11.8 | FDD | IMD31 |
|  | n41 | 2680 | 10 | 50 | 2680 | N/A | TDD | N/A |
|  | n79 | 4420 | 10 | 50 | 4420 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.68 CA\_n28-n39-n79

### 5.68.1 Common for 1 band UL and 2 bands UL CA

#### 5.68.1.1 Operating bands for CA

Table 5.68.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| n28A-n39A-n79A | n28, n39, n79 |

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

Table 5.68.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n28A-n39A-n79A | CA\_n28A-n39A  CA\_n28A-n79A  CA\_n39A-n79A | n28 | 5, 10, 15, 20, 30 | 0 |
|  |  | n39 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n79 | 40, 50, 60, 80, 100 |  |

#### 5.68.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n8-n39-n79, the ΔTIB,c and ΔRIB,c values have already been defined in the spec.

### 5.68.2 Specific for 2 bands UL CA

#### 5.68.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n8A-n39A, CA\_n8A-n41A and CA\_n39A-n41A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD3, IMD4 and IMD5 issuess caused by n28-n39 fall into its own band n79 Rx;

IMD5 issue caused by n28+n79 fall into the its own band n39 Rx;

IMD3 and IMD4 issue caused by n39+n79 fall into the its own band n28 Rx;

#### 5.68.2.2 REFSENS requirements

Based on co-existence studies additional MSDs are needed to be defined, shown in table 5.68.2.2-1.:

Table 5.68.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplexer Mode | IMD order |
| CA\_n28-n39-n79 | n28 | 715 | 5 | 25 | 770 | N/A | FDD | N/A |
|  | n39 | 1902.5 | 5 | 25 | 1902.5 | N/A | TDD | N/A |
|  | n79 | 4520 | 40 | 216 | 4520 | 6.7 | TDD | IMD3 |
|  | n28 | 727.5 | 5 | 25 | 782.5 | N/A | FDD | N/A |
|  | n39 | 1902.5 | 5 | 25 | 1902.5 | N/A | TDD | N/A |
|  | n79 | 4980 | 40 | 216 | 4980 | 4.0 | TDD | IMD41 |
|  | n28 | 715.5 | 5 | 25 | 770.5 | N/A | FDD | N/A |
|  | n39 | 1898 | 5 | 25 | 1898 | 5.7 | TDD | IMD5 |
|  | n79 | 4760 | 40 | 216 | 4760 | N/A | TDD | N/A |
|  | n28 | 730 | 5 | 25 | 785 | 15.6 | FDD | IMD3 |
|  | n39 | 1887.5 | 5 | 25 | 1887.5 | N/A | TDD | N/A |
|  | n79 | 4560 | 40 | 216 | 4560 | N/A | TDD | N/A |
|  | n28 | 725 | 5 | 25 | 780 | 8.5 | FDD | IMD4 |
|  | n39 | 1900 | 5 | 25 | 1900 | N/A | TDD | N/A |
|  | n79 | 4920 | 40 | 216 | 4920 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.69 CA\_n46-n78-n102

### 5.69.1 Common for 1 band UL and 2 bands UL CA

#### 5.69.1.1 Operating bands for CA

Table 5.69.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n46-n78-n102 | n46 | 5150 MHz | – | 5925 MHz | 5150 MHz | – | 5925 MHz | TDD |
|  | n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
|  | n102 | 5925 MHz | – | 6425 MHz | 5925 MHz | – | 6425 MHz | TDD |

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

Table 5.69.1.2-1: Supported bandwidths per CA band combination of band n46+n78+n102

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n46A-n78A-n102A | CA\_n46A-n78A  CA\_n78A-n102A | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n46A-n78A-n102B | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102B | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n46A-n78A-n102C | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102C | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n46A-n78A-n102D | CA\_n46A-n78A  CA\_n78A-n102A | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n46A-n78A-n102E | CA\_n46A-n78A  CA\_n78A-n102A | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n46A-n78A-n102(2A) | CA\_n46A-n78A  CA\_n78A-n102A | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n46(2A)-n78A-n102A | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n46(2A)-n78A-n102B | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102B | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n46(2A)-n78A-n102C | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102C | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n46(2A)-n78A-n102D | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n46(2A)-n78A-n102E | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n46(2A)-n78A-n102(2A) | CA\_n46A-n78A  CA\_n78A-n102A | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n46C-n78A-n102A | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n46C-n78A-n102B | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102B | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n46C-n78A-n102C | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102C | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n46C-n78A-n102D | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n46C-n78A-n102E | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n48C\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n46C-n78A-n102(2A) | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n46D-n78A-n102A | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n46D-n78A-n102B | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102B | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n46D-n78A-n102C | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102C | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n46D-n78A-n102D | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n46D-n78A-n102E | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n46D-n78A-n102(2A) | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n46A-n78(2A)-n102A | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n46A-n78(2A)-n102B | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102B  CA\_n78(2A) | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n46A-n78(2A)-n102C | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102C  CA\_n78(2A) | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n46A-n78(2A)-n102D | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n46A-n78(2A)-n102E | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n46A-n78(2A)-n102(2A) | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | 10,20, 40, 60, 80, 100 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n46(2A)-n78(2A)-n102A | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n46(2A)-n78(2A)-n102B | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102B  CA\_n78(2A) | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n46(2A)-n78(2A)-n102C | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102C  CA\_n78(2A) | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n46(2A)-n78(2A)-n102D | CA\_n46A-n78A  CA\_n78A-n102A | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  | CA\_n78(2A) | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n46(2A)-n78(2A)-n102E | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n46(2A)-n78(2A)-n102(2A) | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46(2A)\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n46C-n78(2A)-n102A | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n46C-n78(2A)-n102B | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102B  CA\_n78(2A) | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n46C-n78(2A)-n102C | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102C  CA\_n78(2A) | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n46C-n78(2A)-n102D | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n46C-n78(2A)-n102E | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n46C-n78(2A)-n102(2A) | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46C\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |
| CA\_n46D-n78(2A)-n102A | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | 20, 40, 60, 80, 100 |  |
| CA\_n46D-n78(2A)-n102B | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102B  CA\_n78(2A) | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102B\_BCS0 |  |
| CA\_n46D-n78(2A)-n102C | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78A-n102C  CA\_n78(2A) | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102C\_BCS0 |  |
| CA\_n46D-n78(2A)-n102D | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102D\_BCS0 |  |
| CA\_n46D-n78(2A)-n102E | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102E\_BCS0 |  |
| CA\_n46D-n78(2A)-n102(2A) | CA\_n46A-n78A  CA\_n78A-n102A  CA\_n78(2A) | n46 | CA\_n46D\_BCS0 | 0 |
|  |  | n78 | CA\_n78(2A)\_BCS2 |  |
|  |  | n102 | CA\_n102(2A)\_BCS0 |  |

#### 5.69.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n46-n78-n102, the ΔTIB,c and ΔRIB,c values are taken from fallbacks.

Table 5.x.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n46-n78-n102 | - | 1.5 | 1.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.x.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n46-n78-n102 | - | 0.5 | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.69.2 Specific for 2 bands UL CA

#### 5.69.2.1 UE co-existence studies

This is a 3-band combination, so uplink harmonic and harmonic mixing analysis is already done in the fallbacks. Only IMD for two uplink configurations is analysed falling inside 3rd band.

Table 5.69.2.2-1 lists Band n46 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Band n46 + Band n102 ULCA not requested.

Table 5.69.2.2-2 lists Band n78 + Band n102 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.69.2.1-1: Band n46 and Band n78 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 5150 | 5925 | 3300 | 3800 |
| DL Frequency [MHz] | 5150 | 5925 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2625 | 1350 | 8450 | 9725 |
| 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) | 6500 | 8550 | 675 | 2450 |
| 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) | 13600 | 15650 | 11750 | 13525 |
| 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) | 11650 | 14475 | 3975 | 6250 |
| 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) | 2700 | 5250 | 16900 | 19450 |
| 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) | 18750 | 21575 | 15050 | 17325 |
| 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) | 10050 | 7275 | 20400 | 16800 |
| 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) | 1100 | 1950 | 11175 | 7850 |
| 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) | 18350 | 21125 | 23900 | 27500 |
| 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) | 20200 | 23250 | 22050 | 25375 |

**Table 5.69.2.1-2: Band n78 and Band n102 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3300 | 3800 | 5925 | 6425 |
| DL Frequency [MHz] | 3300 | 3800 | 5925 | 6425 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2125 | 3125 | 9225 | 10225 |
| 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) | 175 | 1675 | 8050 | 9550 |
| 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) | 12525 | 14025 | 15150 | 16650 |
| 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) | 3475 | 5475 | 13975 | 15975 |
| 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) | 6250 | 4250 | 18450 | 20450 |
| 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) | 15825 | 17825 | 21075 | 23075 |
| 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) | 22400 | 19900 | 9275 | 6775 |
| 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) | 12675 | 10175 | 450 | 2950 |
| 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) | 27000 | 29500 | 19125 | 21625 |
| 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) | 24375 | 26875 | 21750 | 24250 |

Based on the tables above it can be seen that

n46 + n78 IMD4 may affect Rx frequencies of band n102

n78 + n102 IMD4 may affect Rx frequencies of band n46

The non-contiguous uplink of n78(2A) IMD interference analysis has been completed in the fallbacks:

Table 5.69.2.1-3 lists Band n78 + Band n102C 2UL bands CA 1st order triple beat (IMD3) for the UE-to-UE coexistence analysis into the third receive band of Band n46, where Band n102C is the uplink band of the separated RB allocations and Band n78 is the contiguous single uplink carrier.

**Table 5.69.2.1-3: Band n78 and Band n102 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 5925 | 5965 | 6385 | 6425 |  | 20 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 3300 | 3800 | 6385 | 5965 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 3140 | 3320 | 3780 | 3960 |  | 160 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 8070 | 9530 | 15170 | 16630 |  |  |

Based on Table 5.69.2.1-3, 1st order triple beat IMD has no occurrence in band n46. There is no change to the REFSENS requirements as there is no triple beat IMD.

#### 5.69.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. However, given n46 and n102 are shared spectrum access bands the MSD is left as N/A.

Table 5.69.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n46-n78-n102 | n46 | 5315 | 10 | 52 | 5315 | N/A | TDD | N/A |
|  | n78 | 3770 | 10 | 52 | 3770 | N/A | TDD | N/A |
|  | n102 | N/A | 40 | N/A | 5995 | N/Axx | TDD | IMD4 |
|  | n46 | N/A | 10 | N/A | 5530 | N/Axx | TDD | IMD4 |
|  | n78 | 3550 | 10 | 52 | 3550 | N/A | TDD | N/A |
|  | n102 | 6315 | 40 | 216 | 6315 | N/A | TDD | N/A |
| NOTE xx: This is a share spectrum access band, hence no MSD is defined. | | | | | | | | |

## 5.70 CA\_n3-n40-n78

### 5.70.1 Common for 1 band UL and 2 bands UL CA

#### 5.70.1.1 Operating bands for CA

Table 5.70.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n40-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
|  | n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
|  | n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.70.1.2-1: Supported bandwidths per CA band combination of band n3+n40+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n40A-n78A | CA\_n3A-n40A  CA\_n3A-n78A  CA\_n40A-n78A | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n40 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.70.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n40-n78, the ΔTIB,c and ΔRIB,c values are taken from the EN-DC case DC\_3\_n40-n78

Table 5.70.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n40-n78 | 0.6 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.70.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n40-n78 | 0.2 | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.70.2 Specific for 2 bands UL CA

#### 5.70.2.1 UE co-existence studies

This is a 3-band combination, so uplink harmonic and harmonic mixing analysis is already done in the fallbacks. Only IMD for two uplink configurations is analysed.

Table 5.70.2.1-1 lists Band n3 + Band n40 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.70.2.1-2 lists Band n3 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.70.2.1-3 lists Band n40 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.70.2.1-1: Band n3 and Band n40 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 2300 | 2400 |
| DL Frequency [MHz] | 1805 | 1880 | 2300 | 2400 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 515 | 690 | 4010 | 4185 |
| 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) | 1020 | 1270 | 2815 | 3090 |
| 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) | 5720 | 5970 | 6310 | 6585 |
| 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) | 2730 | 3055 | 5115 | 5490 |
| 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) | 1380 | 1030 | 8020 | 8370 |
| 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) | 7430 | 7755 | 8610 | 8985 |
| 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) | 7890 | 7415 | 4840 | 4440 |
| 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) | 3780 | 3330 | 755 | 330 |
| 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) | 10910 | 11385 | 9140 | 9540 |
| 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) | 10320 | 10770 | 9730 | 10155 |

**Table 5.70.2.1-2: Band n3 and Band n78 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 3300 | 3800 |
| DL Frequency [MHz] | 1805 | 1880 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1515 | 2090 | 5010 | 5585 |
| 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) | 380 | 270 | 4815 | 5890 |
| 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) | 6720 | 7370 | 8310 | 9385 |
| 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) | 1330 | 2055 | 8115 | 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) | 4180 | 3030 | 10020 | 11170 |
| 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) | 8430 | 9155 | 11610 | 13185 |
| 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) | 13490 | 11415 | 3840 | 3040 |
| 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) | 7980 | 6330 | 1245 | 2470 |
| 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) | 14910 | 16985 | 10140 | 10940 |
| 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) | 13320 | 14970 | 11730 | 12955 |

**Table 5.70.2.1-3: Band n40 and Band n78 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2300 | 2400 | 3300 | 3800 |
| DL Frequency [MHz] | 2300 | 2400 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 900 | 1500 | 5600 | 6200 |
| 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) | 800 | 1500 | 4200 | 5300 |
| 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) | 7900 | 8600 | 8900 | 10000 |
| 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) | 3100 | 3900 | 7500 | 9100 |
| 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) | 3000 | 1800 | 11200 | 12400 |
| 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) | 10200 | 11000 | 12200 | 13800 |
| 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) | 12900 | 10800 | 6300 | 5400 |
| 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) | 6800 | 5100 | 600 | 700 |
| 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) | 00 | 17600 | 12500 | 13400 |
| 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) | 14500 | 16200 | 13500 | 14800 |

Based on the tables above only the frequency ranges that affect the 3rd RX band are studied and it can be seen that

n3 + n40 IMD5 may affect Rx frequencies of band n78. Since n40 and n78 have simultaneous RX/TX MSD is needed

n3 + n78 IMD5 may affect RX frequencies of band n40. Since n78 and n40 have simultaneous RX/TX MSD is needed

n40 + n78 IMD4 may affect Rx frequencies of band n3, but since n40 and n78 have simultaneous RX/TX this 2ULCA case is invalid, as they will never be present simultaneously.

#### 5.70.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from DC\_3-n40-n78 are reused.

Table 5.70.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n40-n78 | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n40 | 2360 | 5 | 25 | 2360 | N/A | TDD | N/A |
|  | n78 | N/A | 10 | N/A | 3620 | 4.8 | TDD | IMD5 |
|  | n3 | 1720 | 5 | 25 | 1815 | N/A | FDD | N/A |
|  | n40 | N/A | 5 | N/A | 2360 | 4.4 | TDD | IMD5 |
|  | n78 | 3760 | 10 | 50 | 3760 | N/A | TDD | N/A |

## 5.71 CA\_n2-n71-n77

### 5.71.1 Common for 1 band UL and 2 bands UL CA

#### 5.71.1.1 Operating bands for CA

Table 5.71.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n2 | 1850 MHz | – | 1910 MHz | 1930 MHz | – | 1990 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.71.1.2-1: Supported bandwidths per CA band combination of band n2+n71+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n2A-n71A-n77A | CA\_n2A-n71A  CA\_n2A-n77A  CA\_n71A-n77A | n2 | 5, 10, 15, 20, 25, 30, 35, 40 | 0 |
|  |  | n71 | 5, 10, 15, 20, 25, 30, 35 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n2A-n71A-n77(2A) | CA\_n2A-n71A  CA\_n2A-n77A  CA\_n71A-n77A | n2 | 5, 10, 15, 20, 25, 30, 35, 40 | 0 |
|  |  | n71 | 5, 10, 15, 20, 25, 30, 35 |  |
|  |  | n77 | CA\_n77(2A)\_BCS1 |  |

#### 5.71.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n2-n71-n77, the ΔTIB,c and ΔRIB,c values are reused from CA\_n2-n12-n77 are given in the tables below.

Table 5.71.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n2-n71-n77 | 0.6 | 0.3 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.71.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n2-n71-n77 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.71.2 Specific for 2 bands UL CA

#### 5.71.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations: CA n2-n71, CA\_n2-n77 and CA\_n71-n77 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings:

– 3rd and 4th order IMD generated by dual uplink of Band n77 + Band n71 may fall into own Rx of Band n2.

– 3rd, 4th and 5th order IMD generated by dual uplink of Band n71 + Band n2 may fall into own Rx of Band n77.

#### 5.71.2.2 REFSENS requirements

Table 5.71.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n2-n12-n77 are reused.

Table 5.71.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n2-n71-n77 | n2 | N/A | 5 | 25 | 1970 | 16.5 | FDD | IMD32 |
|  | n71 | 670 | 5 | 25 | 624 | N/A | FDD | N/A |
|  | n77 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |
|  | n2 | 1907.5 | 5 | 25 | 1987.5 | N/A | FDD | N/A |
|  | n71 | 695.5 | 5 | 25 | 649.5 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | 50 | 3305 | 16.0 | TDD | IMD31,2 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.72 CA\_n25-n71-n85

### 5.72.1 Common for 1 band UL and 2 bands UL CA

#### 5.72.1.1 Operating bands for CA

Table 5.72.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.72.1.2-1: Supported bandwidths per CA band combination of band n25+n71+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n25A-n71A-n85A | CA\_n25A-n71A  CA\_n25A-n85A | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.72.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n25-n71-n85, the ΔTIB,c and ΔRIB,c values reused from DC\_2-5\_n71 and considering the values for 2band fallback are given in the tables below.

Table 5.72.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n25-n71-n85 | 0.3 | 1 | 1 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.72.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n25-n71-n85 | - | 0.8 | 0.8 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.72.2 Specific for 2 bands UL CA

#### 5.72.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations: CA n25-n71, CA\_n25-n85 and CA\_n71-n85 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings:

– 5th order IMD generated by dual uplink of Band n25 + Band n71 may fall into own Rx of Band n85.

#### 5.72.2.2 REFSENS requirements

Table 5.72.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for DC\_2A-5A\_n71A are reused.

Table 5.72.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n25-n71-n85 | n25 | 1912.5 | 5 | 25 | 1992,5 | N/A | FDD | N/A |
|  | n71 | 665.5 | 5 | 25 | 619.5 | N/A | FDD | N/A |
|  | n85 | N/A | 5 | 25 | 743.5 | 4.2 | FDD | IMD5 |

## 5.73 CA\_n41-n71-n85

### 5.73.1 Common for 1 band UL and 2 bands UL CA

#### 5.73.1.1 Operating bands for CA

Table 5.73.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n41 | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.73.1.2-1: Supported bandwidths per CA band combination of band n41+n71+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n41A-n71A-n85A | CA\_n41A-n71A  CA\_n41A-n85A | n41 | n41 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.73.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n41-n71-n85, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.73.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n41-n71-n85 | 0.3 | 1 | 1 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.73.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n41-n71-n85 | - | 0.8 | 0.8 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.73.2 Specific for 2 bands UL CA

#### 5.73.2.1 UE co-existence studies

Based on the co-existence studies, there is no own Rx impact of the 3rd band for this combination.

#### 5.73.2.2 REFSENS requirements

Based on studies in 5.73.2.1, no IMD interference fall into the own 3rd Rx frequency band, hence no need to define any MSD values.

## 5.74 CA\_n66-n71-n85

### 5.74.1 Common for 1 band UL and 2 bands UL CA

#### 5.74.1.1 Operating bands for CA

Table 5.74.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n85 | 698MHz | – | 716MHz | 728MHz | – | 746 MHz | FDD |

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

Table 5.74.1.2-1: Supported bandwidths per CA band combination of band n66+n71+n85

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n66A-n71A-n85A | CA\_n66A-n71A  CA\_n66A-n85A | n66 | n66 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n85 | n85 channel bandwidths in Table 5.3.5-1 |  |

#### 5.74.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n66-n71-n85, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.74.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n66-n71-n85 | 0.8 | 1 | 1 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.74.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n66-n71-n85 | - | 0.8 | 0.8 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.74.2 Specific for 2 bands UL CA

#### 5.74.2.1 UE co-existence studies

Based on the co-existence studies, there is no own Rx impact of the 3rd band for this combination.

#### 5.74.2.2 REFSENS requirements

Based on studies in 5.74.2.1, no IMD interference fall into the own 3rd Rx frequency band, hence no need to define any MSD values.

## 5.75 CA\_n26-n29-n70

### 5.75.1 Common for 1 band UL and 2 bands UL CA

#### 5.75.1.1 Operating bands for CA

Table 5.75.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n29-n70 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n29 | N/A | – | N/A | 717 MHz | – | 728 MHz | SDL |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |

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

Table 5.75.1.2-1: Supported bandwidths per CA band combination of band n26+n29+n70

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n26A-n29A-n70A | CA\_n26A-n70A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n29 | 5, 10 |  |
|  |  | n70 | 5, 10, 15, 20, 25 |  |

#### 5.75.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n26-n29-n70, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.75.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n26-n29-n70 | 0.5 | - | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.75.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n26-n29-n70 | 0.5 | 0.3 | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.75.2 Specific for 2 bands UL CA

#### 5.75.2.1 UE co-existence studies

Table 5.75.2.2-1 lists Band n26 + Band n70 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.75.2.2-1: Band n26 and Band n70 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequencies (MHz) | 814 | 849 | 1695 | 1710 |
| 2nd order IMD products | |fx\_low – fy\_high| | |fx\_high – fy\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 846 | 896 | 2509 | 2559 |
| 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) | 3 | 82 | 2541 | 2606 |
| 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) | 3323 | 3408 | 4204 | 4269 |
| 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) | 732 | 852 | 4236 | 4316 |
| 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) | 4137 | 4257 | 5899 | 5979 |
| 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) | 1692 | 1792 | 5018 | 5118 |
| 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) | 5931 | 6026 | 1546 | 1701 |
| 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) | 7594 | 7689 | 4951 | 5106 |
| 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) | 3387 | 3502 | 843 | 978 |
| 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) | 6713 | 6828 | 5832 | 5967 |

Based on the table above it can be seen that there is no n26 + n70 IMD may affect Rx frequencies of band n29.

#### 5.75.2.2 REFSENS requirements

Based on co-existence studies on 5.75.2.1, no need to define exceptional REFSENS requirements.

## 5.76 CA\_n5-n25-n29

### 5.76.1 Common for 1 band UL and 2 bands UL CA

#### 5.76.1.1 Operating bands for CA

Table 5.76.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n25-n29 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
|  | n25 | 1850 MHz | – | 1915 MHz | 1930 MHz | – | 1995 MHz | FDD |
|  | n29 | N/A | – | N/A | 717 MHz | – | 728 MHz | SDL |

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

Table 5.76.1.2-1: Supported bandwidths per CA band combination of band n5+n25+n29

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n25A-n29A | CA\_n5A-n25A | n5 | 5, 10, 15, 20 | 0 |
|  |  | n25 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n29 | 5, 10 |  |

#### 5.76.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5-n25-n29, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.76.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n25-n29 | 0.5 | 0.3 | - |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.76.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n25-n29 | 0.5 | - | 0.3 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.76.2 Specific for 2 bands UL CA

#### 5.76.2.1 UE co-existence studies

Table 5.76.2.2-1 lists Band n5 + Band n25 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.76.2.2-1: Band n5 and Band n25 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequencies (MHz) | 824 | 849 | 1850 | 1915 |
| 2nd order IMD products | |fx\_low – fy\_high| | |fx\_high – fy\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1001 | 1091 | 2674 | 2764 |
| 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) | 152 | 267 | 2851 | 3006 |
| 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) | 3498 | 3613 | 4524 | 4679 |
| 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) | 557 | 697 | 4701 | 4921 |
| 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) | 4322 | 4462 | 6374 | 6594 |
| 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) | 2002 | 2182 | 5348 | 5528 |
| 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) | 6551 | 6836 | 1381 | 1546 |
| 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) | 8224 | 8509 | 5146 | 5311 |
| 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) | 3852 | 4097 | 1153 | 1358 |
| 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) | 7198 | 7443 | 6172 | 6377 |

Based on the table above it can be seen that no n5 + n25 IMD may affect Rx frequencies of band n29.

#### 5.76.2.2 REFSENS requirements

Based on co-existence studies on 5.76.2.1, no need to define exceptional REFSENS requirements.

## 5.77 CA\_n7-n12-n71

### 5.77.1 Common for 1 band UL and 2 bands UL CA

#### 5.77.1.1 Operating bands for CA

Table 5.77.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n7 | 2500 MHz | – | 2570MHz | 2620 MHz | – | 2690 MHz | FDD |
| n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.77.1.2-1: Supported bandwidths per CA band combination of band n7+n12+n71

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n12A-n71A | CA\_n7A-n12A  CA\_n7A-n71A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n12 | 5, 10, 15 |  |
|  |  | n71 | 5, 10, 15, 20 |  |

#### 5.77.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7A-n12A-n71A, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.77.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7A-n12A-n71A | 0.3 | 1 | 1 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.77.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7A-n12A-n71A | 0.2 | 0.8 | 0.8 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.77.2 Specific for 2 bands UL CA

#### 5.77.2.1 UE co-existence studies

Based on the co-existence studies, there is no own Rx impact of the 3rd band for this combination.

#### 5.77.2.2 REFSENS requirements

Based on studies in 5.77.2.1, no IMD interference fall into the own 3rd Rx frequency band, hence no need to define any MSD values.

## 5.78 CA\_n26-n29-n66

### 5.78.1 Common for 1 band UL and 2 bands UL CA

#### 5.78.1.1 Operating bands for CA

Table 5.78.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n29-n66 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n29 | N/A | – | N/A | 717 MHz | – | 728 MHz | SDL |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.78.1.2-1: Supported bandwidths per CA band combination of band n26+n29+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n26A-n29A-n66A | CA\_n26A-n66A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n29 | 5, 10 |  |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n26A-n29A-n66(2A) | CA\_n26A-n66A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n29 | 5, 10 |  |
|  |  | n66 | CA\_n66(2A)\_BCS1 |  |

#### 5.78.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n26-n29-n66, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.78.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n26-n29-n66 | 0.5 | - | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.78.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n26-n29-n66 | 0.5 | 0.3 | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.78.2 Specific for 2 bands UL CA

#### 5.78.2.1 UE co-existence studies

Based on the co-existence studies, it can be observed:

IMD4 issue caused by n26+n66 falls into band n29 Rx;

#### 5.78.2.2 REFSENS requirements

Based on co-existence studies on 5.78.2.1, additional MSD is needed to be defined, shown in table 5.78.2.2-1.

**Table 5.78.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n26-n29-n66 | n26 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n29 | N/A | 5 | N/A | 720 | 9.4 | SDL | IMD4 |
|  | n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |

## 5.79 CA\_n26-n48-n66

### 5.79.1 Common for 1 band UL and 2 bands UL CA

#### 5.79.1.1 Operating bands for CA

Table 5.79.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n48-n66 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.79.1.2-1: Supported bandwidths per CA band combination of band n26+n48+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n26A-n48A-n66A | CA\_n26A-n48A  CA\_n26A-n66A  CA\_n48A-n66A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n48 | 5, 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n26A-n48(2A)-n66A | CA\_n26A-n48A  CA\_n26A-n66A  CA\_n48A-n66A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n48 | CA\_n48(2A)\_BCS0 |  |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
| CA\_n26A-n48A-n66(2A) | CA\_n26A-n48A  CA\_n26A-n66A  CA\_n48A-n66A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n48 | 5, 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n66 | CA\_n66(2A)\_BCS0 |  |
| CA\_n26A-n48(2A)-n66(2A) | CA\_n26A-n48A  CA\_n26A-n66A  CA\_n48A-n66A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n48 | CA\_n48(2A)\_BCS0 |  |
|  |  | n66 | CA\_n66(2A)\_BCS0 |  |

#### 5.79.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n26-n48-n66, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.79.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n26-n48-n66 | 0.3 | 0.8 | 0.6 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.79.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n26-n48-n66 | - | 0.5 | 0.2 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.79.2 Specific for 2 bands UL CA

#### 5.79.2.1 UE co-existence studies

Based on the co-existence studies, it can be observed:

No IMD issue caused by n26+n48 falls into band n66 Rx;

IMD5 issue caused by n26+n66 falls into band n48 Rx;

No IMD issue caused by n48+n66 falls into band n26 Rx;

#### 5.79.2.2 REFSENS requirements

Based on co-existence studies on 5.79.2.1, additional MSD is needed to be defined, shown in table 5.79.2.2-1.

**Table 5.79.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n26-n48-n66 | n26 | 829 | 5 | 25 | 874 | N/A | FDD | N/A |
|  | n48 | N/A | 10 | N/A | 3622 | 3.6 | TDD | IMD5 |
|  | n66 | 1760 | 5 | 25 | 2160 | N/A | FDD | N/A |

## 5.80 CA\_n26-n48-n70

### 5.80.1 Common for 1 band UL and 2 bands UL CA

#### 5.80.1.1 Operating bands for CA

Table 5.80.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n48-n70 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n48 | 3550 MHz | – | 3700 MHz | 3550 MHz | – | 3700 MHz | TDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |

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

Table 5.80.1.2-1: Supported bandwidths per CA band combination of band n26+n48+n70

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n26A-n48A-n70A | CA\_n26A-n48A  CA\_n26A-n70A  CA\_n48A-n70A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n48 | 5, 10, 15, 20, 40, 50, 60, 80, 90, 100 |  |
|  |  | n70 | 5, 10, 15, 20, 25 |  |

#### 5.80.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n26-n48-n70, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.80.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n26-n48-n70 | 0.3 | 0.8 | 0.6 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.80.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n26-n48-n70 | - | 0.5 | 0.2 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.80.2 Specific for 2 bands UL CA

#### 5.80.2.1 UE co-existence studies

Based on the co-existence studies, it can be observed:

IMD3 issue caused by n26+n48 falls into band n70 Rx;

No IMD issue caused by n26+n70 falls into band n48 Rx;

No IMD issue caused by n48+n70 falls into band n26 Rx;

#### 5.80.2.2 REFSENS requirements

Based on co-existence studies on 5.80.2.1, additional MSD is needed to be defined, shown in table 5.80.2.2-1.

**Table 5.80.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n26-n48-n70 | n26 | 826.5 | 5 | 25 | 871.5 | N/A | FDD | N/A |
|  | n48 | 3653 | 10 | 50 | 3653 | N/A | TDD | N/A |
|  | n70 | N/A | 5 | N/A | 2000 | 13.2 | FDD | IMD3 |

## 5.81 CA\_n26-n66-n71

### 5.81.1 Common for 1 band UL and 2 bands UL CA

#### 5.81.1.1 Operating bands for CA

Table 5.81.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n66-n71 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.81.1.2-1: Supported bandwidths per CA band combination of band n26+n66+n71

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n26A-n66A-n71A | CA\_n26A-n66A  CA\_n66A-n71A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n71 | 5, 10, 15, 20 |  |
| CA\_n26A-n66(2A)-n71A | CA\_n26A-n66A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n71 | 5, 10, 15, 20 |  |

#### 5.81.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n26-n66-n71, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.81.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n26-n66-n71 | 0.5 | 0.3 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.81.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n26-n66-n71 | 0.5 | - | 0.3 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.81.2 Specific for 2 bands UL CA

#### 5.81.2.1 UE co-existence studies

Based on the co-existence studies, it can be observed:

No IMD issue caused by n26+n66 falls into band n71 Rx;

IMD5 issue caused by n66+n71 falls into band n26 Rx;

#### 5.81.2.2 REFSENS requirements

Based on co-existence studies on 5.81.2.1, additional MSD is needed to be defined, shown in table 5.81.2.2-1.

**Table 5.81.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n26-n66-n71 | n26 | N/A | 5 | N/A | 892 | 4.2 | FDD | IMD5 |
|  | n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |
|  | n71 | 665.5 | 5 | 25 | 619.5 | N/A | FDD | N/A |

## 5.82 CA\_n26-n66-n77

### 5.82.1 Common for 1 band UL and 2 bands UL CA

#### 5.82.1.1 Operating bands for CA

Table 5.82.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n66-n77 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.82.1.2-1: Supported bandwidths per CA band combination of band n26+n66+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n26A-n66A-n77A | CA\_n26A-n66A  CA\_n26A-n77A  CA\_n66A-n77A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40 |  |

#### 5.82.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n26-n66-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.82.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n26-n66-n77 | 0.6 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.82.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n26-n66-n77 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.82.2 Specific for 2 bands UL CA

#### 5.82.2.1 UE co-existence studies

Based on the co-existence studies, it can be observed:

IMD3/4/5 issue caused by n26+n66 falls into band n77 Rx;

IMD3 issue caused by n26+n77 falls into band n66 Rx;

No IMD issue caused by n66+n70 falls into band n26 Rx;

#### 5.82.2.2 REFSENS requirements

Based on co-existence studies on 5.82.2.1, additional MSD is needed to be defined, shown in table 5.82.2.2-1.

**Table 5.82.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n26-n66-n77 | n26 | 845 | 5 | 25 | 890 | N/A | FDD | N/A |
|  | n66 | 1775 | 5 | 25 | 2175 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3465 | 16.1 | TDD | IMD3 |
|  | n26 | 826.5 | 5 | 25 | 871.5 | N/A | FDD | N/A |
|  | n66 | 1712.5 | 5 | 25 | 2112.5 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 4192 | 8.2 | TDD | IMD4 |
|  | n26 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
|  | n66 | 1735 | 5 | 25 | 2135 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3535 | 3.3 | TDD | IMD5 |
|  | n26 | 826.5 | 5 | 25 | 871.5 | N/A | FDD | N/A |
|  | n66 | N/A | 5 | N/A | 2142 | 13.2 | FDD | IMD3 |
|  | n77 | 3795 | 10 | 50 | 3795 | N/A | TDD | N/A |

## 5.83 CA\_n26-n70-n77

### 5.83.1 Common for 1 band UL and 2 bands UL CA

#### 5.83.1.1 Operating bands for CA

Table 5.83.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n70-n77 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.83.1.2-1: Supported bandwidths per CA band combination of band n26+n70+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n26A-n70A-n77A | CA\_n26A-n70A  CA\_n26A-n77A  CA\_n70A-n77A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n70 | 5, 10, 15, 20, 25 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40 |  |

#### 5.83.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n26-n70-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.83.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n26-n70-n77 | 0.6 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.83.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n26-n70-n77 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.83.2 Specific for 2 bands UL CA

#### 5.83.2.1 UE co-existence studies

Based on the co-existence studies, it can be observed:

IMD3/4/5 issue caused by n26+n70 falls into band n77 Rx;

IMD3 issue caused by n26+n77 falls into band n70 Rx;

IMD4 issue caused by n70+n77 falls into band n26 Rx, but there is no need to define MSD since there is no suitable test configurations within the aggressor/victim band which can be placed/found considering the channel bandwidths;

#### 5.83.2.2 REFSENS requirements

Based on co-existence studies on 5.83.2.1, additional MSD is needed to be defined, shown in table 5.83.2.2-1.

**Table 5.83.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n26-n70-n77 | n26 | 845 | 5 | 25 | 890 | N/A | FDD | N/A |
|  | n70 | 1700 | 5 | 25 | 2000 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3390 | 16.1 | TDD | IMD35 |
|  | n26 | 826.5 | 5 | 25 | 871.5 | N/A | FDD | N/A |
|  | n70 | 1700 | 5 | 25 | 2000 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 4179.5 | 8.2 | TDD | IMD45 |
|  | n26 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
|  | n70 | 1700 | 5 | 25 | 2000 | N/A | FDD | N/A |
|  | n77 | N/A | 10 | N/A | 3430 | 3.3 | TDD | IMD55 |
|  | n26 | 826.5 | 5 | 25 | 871.5 | N/A | FDD | N/A |
|  | n70 | N/A | 5 | N/A | 2000 | 13.2 | FDD | IMD35 |
|  | n77 | 3653 | 10 | 50 | 3653 | N/A | TDD | N/A |
| NOTE 5: For a UE which supports this band combination only when the Band n77 frequency range restriction defined in NOTE 12 of Table 5.2-1 applies, the MSD test point(s) cannot be verified for the band combination and the test point(s) can be skipped. | | | | | | | | |

## 5.84 CA\_n5-n29-n66

### 5.84.1 Common for 1 band UL and 2 bands UL CA

#### 5.84.1.1 Operating bands for CA

Table 5.84.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n29-n66 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
|  | n29 | N/A | – | N/A | 717 MHz | – | 728 MHz | SDL |
|  | n66 | 1710 MHz | – | 1780 MHz | 2110 MHz | – | 2200 MHz | FDD |

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

Table 5.84.1.2-1: Supported bandwidths per CA band combination of band n5+n29+n66

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n29A-n66A | CA\_n5A-n66A | n5 | 5, 10, 15, 20 | 0 |
|  |  | n29 | 5, 10 |  |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 40 |  |

#### 5.84.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5-n29-n66, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.84.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n29-n66 | 0.5 | - | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.84.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n29-n66 | 0.5 | 0.3 | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.84.2 Specific for 2 bands UL CA

#### 5.84.2.1 UE co-existence studies

Table 5.84.2.1-1 lists Band n5 + Band n66 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.84.2.1-1: Band n5 and Band n66 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequencies (MHz) | 824 | 849 | 1710 | 1780 |
| 2nd order IMD products | |fx\_low – fy\_high| | |fx\_high – fy\_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) | 12 | 132 | 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) | 3558 | 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 | |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) | 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 limits (MHz) | 1722 | 1912 | 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) | 5991 | 6296 | 1516 | 1686 |
| 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) | 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 limits (MHz) | 3432 | 3692 | 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 |

Based on the table above it can be seen that n5 + n66 IMD4 may affect Rx frequencies of band n29.

#### 5.84.2.2 REFSENS requirements

Based on co-existence studies on 5.84.2.1, there is a need to define MSD values. MSD values from DC\_5-13\_n66 are reused as below.

**Table 5.84.2.2-1: MSD for the CA configuration**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n5-n29-n66 | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n29 | N/A | 5 | N/A | 720 | 9.4 | SDL | IMD4 |
|  | n66 | 1770 | 5 | 25 | 2170 | N/A | FDD | N/A |

## 5.85 CA\_n1-n7-n105

### 5.85.1 Common for 1 band UL and 2 bands UL CA

#### 5.85.1.1 Operating bands for CA

Table 5.85.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1A-n7A-n105A | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.85.1.2-1: Supported bandwidths per CA band combination of band n1+n7+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n7A-n105A | CA\_n1A-n7A  CA\_n1A-n105A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n7A-n105A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.85.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n7-n105, the ΔTIB,c and ΔRIB,c values are reused from DC\_1-7\_n105 and are given in the tables below.

Table 5.85.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1A-n7A-n105A | 0.5 | 0.6 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.85.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n1A-n7A-n105A | - | - | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.85.2 Specific for 2 bands UL CA

#### 5.85.2.1 UE co-existence studies

Table 5.85.2.2-1 lists Band n1 + Band n7 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.85.2.2-2 lists Band n1 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.85.2.2-3 lists Band n7 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.85.2.2-1: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 2500 | 2570 |
| DL Frequency [MHz] | 2110 | 2170 | 2620 | 2690 |
| 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 |
| 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 |
| 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 | |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 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 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 |

**Table 5.85.2.2-2: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1920 | 1980 | 663 | 703 |
| DL Frequency [MHz] | 2110 | 2170 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1317 | 1217 | 2583 | 2683 |
| 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) | 3137 | 3297 | 654 | 514 |
| 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) | 4503 | 4663 | 3246 | 3386 |
| 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) | 5057 | 5277 | 9 | 189 |
| 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) | 2434 | 2634 | 5166 | 5366 |
| 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) | 6423 | 6643 | 3909 | 4089 |
| 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) | 892 | 672 | 7257 | 6977 |
| 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) | 1731 | 1971 | 4614 | 4354 |
| 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) | 4572 | 4792 | 8343 | 8623 |
| 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) | 5829 | 6069 | 7086 | 7346 |

**Table 5.85.2.2-3: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 663 | 703 |
| DL Frequency [MHz] | 2620 | 2690 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1907 | 1797 | 3163 | 3273 |
| 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) | 4297 | 4477 | 1244 | 1094 |
| 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) | 5663 | 5843 | 3826 | 3976 |
| 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) | 6797 | 7047 | 581 | 391 |
| 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) | 3594 | 3814 | 6326 | 6546 |
| 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) | 8163 | 8413 | 4489 | 4679 |
| 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) | 312 | 82 | 9617 | 9297 |
| 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) | 2891 | 3151 | 6384 | 6094 |
| 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) | 5152 | 5382 | 10663 | 10983 |
| 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) | 6989 | 7249 | 8826 | 9116 |

Based on the tables above it can be seen that

* n1 + n7 IMD2 and IMD5 may affect Rx frequencies of band n105.
* n1 + n105 IMD2 and IMD4 may affect Rx frequencies of band n7.
* n7 + n105 there is no IMD products falling inside RX frequencies of band n1.

#### 5.85.2.2 REFSENS requirements

MSD values have been re-used from DC\_2A\_n41A-n71A to find an MSD value for n105 (from n71 – same frequency) caused by n1 (from n2 slightly lower uplink frequency) and n7 (from n41 – same frequency).

For MSD value capturing the IMD5 in n105 a similar IMD5 case is found in CA\_n1-n7-n8.

MSD values have been re-used from DC\_1A-41A\_n28A to find an MSD value for n7 (from n41) caused by n1 and n105 (from n28).

**Table 5.85.2.3-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n7-n105 | n1 | 1935 | 5 | 25 | 2125 | N/A | FDD | N/A |
|  | n7 | 2565 | 10 | 50 | 2685 | N/A | FDD | N/A |
|  | n105 | N/A | 5 | N/A | 630 | 28.7 | FDD | IMD2 |
|  | n1 | 1925 | 5 | 25 | 2115 | N/A | FDD | N/A |
|  | n7 | 2565 | 10 | 50 | 2565 | N/A | FDD | N/A |
|  | n105 | N/A | 5 | N/A | 645 | 1 | FDD | IMD5 |
|  | n1 | 1968.5 | 5 | 25 | 2158.5 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2634.5 | 30 | FDD | IMD22 |
|  | n105 | 666 | 5 | 25 | 615 | N/A | FDD | NA |
| NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.86 CA\_n3-n7-n105

### 5.86.1 Common for 1 band UL and 2 bands UL CA

#### 5.86.1.1 Operating bands for CA

Table 5.86.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3A-n7A-n105A | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.86.1.2-1: Supported bandwidths per CA band combination of band n3+n7+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n7A-n105A | CA\_n3A-n7A  CA\_n3A-n105A | n3 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n7A-n105A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.86.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n7-n105, the ΔTIB,c and ΔRIB,c values are reused from DC\_3-7-n105 and are given in the tables below.

Table 5.86.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3A-n7A-n105A | 0.5 | 0.5 | 0.6 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.86.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n3A-n7A-n105A | - | - | 0.3 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.86.2 Specific for 2 bands UL CA

#### 5.86.2.1 UE co-existence studies

Table 5.86.2.2-1 lists Band n3 + Band n7 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.86.2.2-2 lists Band n3 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.86.2.2-3 lists Band n7 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.86.2.2-1: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 2500 | 2570 |
| DL Frequency [MHz] | 1805 | 1880 | 2620 | 2690 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 715 | 860 | 4210 | 4355 |
| 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) | 850 | 1070 | 3215 | 3430 |
| 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) | 5920 | 6140 | 6710 | 6925 |
| 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) | 2560 | 2855 | 5715 | 6000 |
| 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) | 1720 | 1430 | 8420 | 8710 |
| 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) | 7630 | 7925 | 9210 | 9495 |
| 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) | 8570 | 8215 | 4640 | 4270 |
| 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) | 4290 | 3930 | 355 | 10 |
| 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) | 11710 | 12065 | 9340 | 9710 |
| 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) | 10920 | 11280 | 10130 | 10495 |

**Table 5.86.2.2-2: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 1710 | 1785 | 663 | 703 |
| DL Frequency [MHz] | 1805 | 1880 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1122 | 1007 | 2373 | 2488 |
| 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) | 2717 | 2907 | 459 | 304 |
| 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) | 4083 | 4273 | 3036 | 3191 |
| 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) | 4427 | 4692 | 204 | 399 |
| 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) | 2014 | 2244 | 4746 | 4976 |
| 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) | 5793 | 6058 | 3699 | 3894 |
| 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) | 1102 | 867 | 6477 | 6137 |
| 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) | 1311 | 1581 | 4029 | 3724 |
| 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) | 4362 | 4597 | 7503 | 7843 |
| 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) | 5409 | 5679 | 6456 | 6761 |

**Table 5.86.2.2-3: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 663 | 703 |
| DL Frequency [MHz] | 2620 | 2690 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1907 | 1797 | 3163 | 3273 |
| 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) | 4297 | 4477 | 1244 | 1094 |
| 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) | 5663 | 5843 | 3826 | 3976 |
| 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) | 6797 | 7047 | 581 | 391 |
| 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) | 3594 | 3814 | 6326 | 6546 |
| 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) | 8163 | 8413 | 4489 | 4679 |
| 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) | 312 | 82 | 9617 | 9297 |
| 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) | 2891 | 3151 | 6384 | 6094 |
| 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) | 5152 | 5382 | 10663 | 10983 |
| 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) | 6989 | 7249 | 8826 | 9116 |

Based on the tables above it can be seen that

* n3 + n7 there is no IMD products falling inside RX frequencies of band n105.
* n3 + n105 there is no IMD products falling inside RX frequencies of band n7.
* n7 + n105 IMD2 may affect Rx frequencies of band n3.

#### 5.86.2.2 REFSENS requirements

MSD values have been re-used from DC\_3-7-n105.

**Table 5.86.2.3-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n7-n105 | n3 | N/A | 5 | N/A | 1875 | 16.5 | FDD | IMD2 |
|  | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
|  | n105 | 675 | 5 | 25 | 624 | N/A | FDD | N/A |

## 5.87 CA\_n7-n78-n105

### 5.87.1 Common for 1 band UL and 2 bands UL CA

#### 5.87.1.1 Operating bands for CA

Table 5.87.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7A-n78A-n105A | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.87.1.2-1: Supported bandwidths per CA band combination of band n7+n78+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n78A-n105A | CA\_n7A-n78A  CA\_n7A-n105A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  | CA\_n78A-n105A | n78 | 10, 15, 20, 25, 30, 40, 50, 60, 700, 80, 90, 100 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.87.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n78-n105, the ΔTIB,c and ΔRIB,c values are reused from DC\_7\_n71-n78 and are given in the tables below.

Table 5.87.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7A-n78A-n105A | 0.3 | 0.8 | 0.5 |
| NOTE \*: “-” denotes ΔTIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.87.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)\*** | | |
| **Component band in order of bands in configuration\*\*** | | |
| CA\_n7A-n78A-n105A | - | 0.5 | 0.2 |
| NOTE \*: “-” denotes ΔRIB,c = 0.  NOTE \*\*: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.87.2 Specific for 2 bands UL CA

#### 5.87.2.1 UE co-existence studies

Table 5.87.2.2-1 lists Band n7 + Band n78 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.87.2.2-2 lists Band n7 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.87.2.2-3 lists Band n78 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.87.2.2-1: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 3300 | 3800 |
| DL Frequency [MHz] | 2620 | 2690 | 3300 | 3800 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 730 | 1300 | 5800 | 6370 |
| 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) | 1200 | 1840 | 4030 | 5100 |
| 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) | 8300 | 8940 | 9100 | 10170 |
| 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) | 3700 | 4410 | 7330 | 8900 |
| 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) | 2600 | 1460 | 11600 | 12740 |
| 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) | 10800 | 11510 | 12400 | 13970 |
| 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) | 12700 | 10630 | 6980 | 6200 |
| 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) | 6400 | 4760 | 1110 | 100 |
| 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) | 15700 | 17770 | 13300 | 14080 |
| 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) | 14900 | 16540 | 14100 | 15310 |

**Table 5.87.2.2-2: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 663 | 703 |
| DL Frequency [MHz] | 2620 | 2690 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1907 | 1797 | 3163 | 3273 |
| 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) | 4297 | 4477 | 1244 | 1094 |
| 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) | 5663 | 5843 | 3826 | 3976 |
| 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) | 6797 | 7047 | 581 | 391 |
| 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) | 3594 | 3814 | 6326 | 6546 |
| 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) | 8163 | 8413 | 4489 | 4679 |
| 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) | 312 | 82 | 9617 | 9297 |
| 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) | 2891 | 3151 | 6384 | 6094 |
| 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) | 5152 | 5382 | 10663 | 10983 |
| 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) | 6989 | 7249 | 8826 | 9116 |

**Table 5.87.2.2-3: IMD analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 3300 | 3800 | 663 | 703 |
| DL Frequency [MHz] | 3300 | 3800 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3137 | 2597 | 3963 | 4503 |
| 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) | 5897 | 6937 | 2474 | 1894 |
| 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) | 7263 | 8303 | 4626 | 5206 |
| 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) | 9197 | 10737 | 1811 | 1191 |
| 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) | 5194 | 6274 | 7926 | 9006 |
| 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) | 10563 | 12103 | 5289 | 5909 |
| 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) | 488 | 1148 | 14537 | 12497 |
| 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) | 4491 | 5611 | 10074 | 8494 |
| 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) | 5952 | 6612 | 13863 | 15903 |
| 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) | 8589 | 9709 | 11226 | 12806 |

Based on the tables above it can be seen that

* n7 + n78 IMD5 may affect Rx frequencies of band n105.
* n7 + n105 IMD4 may affect Rx frequencies of band n78.
* n78 + n105 IMD2 may affect Rx frequencies of band n7.

#### 5.87.2.2 REFSENS requirements

MSD values have been re-used from DC\_7\_n71-n78 for IMD4 and IMD5 cases.

MSD values have been re-used from DC\_71A\_n38A-n78A for the IMD2 case.

**Table 5.87.2.3-1: MSD due to IMD issue**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n78-n105 | n7 | 2555 | 5 | 25 | 2675 | N/A | FDD | N/A |
|  | n78 | 3520 | 10 | 50 | 3520 | N/A | TDD | N/A |
|  | n105 | N/A | 5 | N/A | 625 | 3.9 | FDD | IMD5 |
|  | n7 | 2550 | 5 | 25 | 2670 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3714 | 9.7 | TDD | IMD4 |
|  | n105 | 693 | 5 | 25 | 642 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2625 | 28.7 | FDD | IMD2 |
|  | n78 | 3308 | 10 | 50 | 3308 | N/A | TDD | N/A |
|  | n105 | 683 | 5 | 25 | 632 | N/A | FDD | N/A |

## 5.88 CA\_n7-n40-n105

### 5.88.1 Common for 1 band UL and 2 bands UL CA

#### 5.88.1.1 Operating bands for CA

Table 5.88.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7A-n40A-n105A | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
|  | n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
|  | n105 | 663 MHz | – | 703 MHz | 612 MHz | – | 652 MHz | FDD |

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

Table 5.88.1.2-1: Supported bandwidths per CA band combination of band n7+n40+n105

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n40A-n105A | CA\_n7A-n40A  CA\_n7A-n105A  CA\_n40A-n105A | n7 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
|  |  | n40 | 5,10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
|  |  | n105 | 5, 10, 15, 20, 25, 30, 35 |  |

#### 5.88.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n40-n105, the ΔTIB,c and ΔRIB,c values are reused from CA\_n7-n8-n40 and are given in the tables below.

Table 5.88.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7-n40-n105 | 0.5 | 0.6 | 0.6 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.88.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7-n40-n105 | - | 0.5 | 0.2 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.88.2 Specific for 2 bands UL CA

#### 5.88.2.1 UE co-existence studies

This is a 3-band combination, so uplink harmonic and harmonic mixing analysis is already done in the fallbacks. Only IMD for two uplink configurations is analysed.

Table 5.88.2.2-1 lists Band n7 + Band n40 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.88.2.2-2 lists Band n7 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.88.2.2-3 lists Band n40 + Band n105 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

**Table 5.88.2.2-1: Band n7 and Band n40 UL IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 2300 | 2400 |
| DL Frequency [MHz] | 2620 | 2690 | 2300 | 2400 |
| 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 | 100 | 4800 | 4970 |
| 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) | 2600 | 2840 | 2030 | 2300 |
| 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) | 7300 | 7540 | 7100 | 7370 |
| 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) | 5100 | 5410 | 4330 | 4700 |
| 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) | 200 | 540 | 9600 | 9940 |
| 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) | 9800 | 10110 | 9400 | 9770 |
| 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) | 7100 | 6630 | 7980 | 7600 |
| 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) | 2200 | 1760 | 3110 | 2700 |
| 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) | 11700 | 12170 | 12300 | 12680 |
| 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) | 11900 | 12340 | 12100 | 12510 |

**Table 5.88.2.2-2: Band n7 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2500 | 2570 | 663 | 703 |
| DL Frequency [MHz] | 2620 | 2690 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1907 | 1797 | 3163 | 3273 |
| 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) | 4297 | 4477 | 1244 | 1094 |
| 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) | 5663 | 5843 | 3826 | 3976 |
| 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) | 6797 | 7047 | 581 | 391 |
| 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) | 3594 | 3814 | 6326 | 6546 |
| 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) | 8163 | 8413 | 4489 | 4679 |
| 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) | 312 | 82 | 9617 | 9297 |
| 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) | 2891 | 3151 | 6384 | 6094 |
| 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) | 5152 | 5382 | 10663 | 10983 |
| 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) | 6989 | 7249 | 8826 | 9116 |

**Table 5.88.2.2-3: Band n40 and Band n105 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL Frequency [MHz] | 2300 | 2400 | 663 | 703 |
| DL Frequency [MHz] | 2300 | 2400 | 612 | 652 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1737 | 1597 | 2963 | 3103 |
| 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) | 3897 | 4137 | 1074 | 894 |
| 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) | 5263 | 5503 | 3626 | 3806 |
| 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) | 6197 | 6537 | 411 | 191 |
| 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) | 3194 | 3474 | 5926 | 6206 |
| 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) | 7563 | 7903 | 4289 | 4509 |
| 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) | 512 | 252 | 8937 | 8497 |
| 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) | 2491 | 2811 | 5874 | 5494 |
| 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) | 4952 | 5212 | 9863 | 10303 |
| 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) | 6589 | 6909 | 8226 | 8606 |

Based on the tables above it can be seen that

* n7 + n40 there is no IMD products falling inside RX frequencies of band n105.
* n7 + n105 there is no IMD products falling inside RX frequencies of band n40.
* n40 + n105 IMD5 may affect Rx frequencies of band n7.

#### 5.88.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. MSD values from DC\_7A-28A\_n40A are reused, for IMD5.

Table 5.88.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n40-n105 | n7 | N/A | 5 | N/A | 2655 | 5.9 | FDD | IMD5 |
|  | n40 | 2352 | 5 | 25 | 2352 | N/A | TDD | N/A |
|  | n105 | 683 | 5 | 25 | 632 | N/A | FDD | N/A |

## 5.89 CA\_n12-n71-n77

### 5.89.1 Common for 1 band UL and 2 bands UL CA

#### 5.89.1.1 Operating bands for CA

Table 5.89.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |
| n77 | 3300 MHz | – | 4200 MHz | 3300 MHz | – | 4200 MHz | TDD |

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

Table 5.89.1.2-1: Supported bandwidths per CA band combination of band n12+n71+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n12A-n71A-n77A | CA\_n12A-n77A  CA\_n71A-n77A | n12 | 5, 10, 15 | 0 |
|  |  | n71 | 5, 10, 15, 20 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

#### 5.89.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n12-n71-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.89.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n12-n71-n77 | 1 | 1 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.89.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n12-n71-n77 | 0.8 | 0.8 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.89.2 Specific for 2 bands UL CA

#### 5.89.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations: CA n12-n77and CA\_n71-n77 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings:

– 5th order IMD generated by dual uplink of Band n77 + Band n12 may fall into own Rx of Band n71.

– 5th order IMD generated by dual uplink of Band n77 + Band n71 may fall into own Rx of Band n12.

#### 5.89.2.2 REFSENS requirements

Table 5.x.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n5A-n12A-n77A are reused.

Table 5.89.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n12-n71-n77 | n12 | N/A | 5 | N/A | 732 | 4.4 | FDD | IMD5 |
|  | n71 | 693 | 5 | 25 | 647 | N/A | FDD | N/A |
|  | n77 | 3504 | 10 | 50 | 3504 | N/A | TDD | N/A |
|  | n12 | 711 | 5 | 25 | 741 | N/A | FDD | N/A |
|  | n71 | N/A | 5 | N/A | 646 | 3.9 | FDD | IMD5 |
|  | n77 | 3490 | 10 | 50 | 3490 | N/A | TDD | N/A |

## 5.90 CA\_n2-n12-n71

### 5.90.1 Common for 1 band UL and 2 bands UL CA

#### 5.90.1.1 Operating bands for CA

Table 5.90.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Uplink (UL) band | | | Downlink (DL) band | | | Duplex  mode |
| BS receive / UE transmit | | | BS transmit / UE receive | | |
| FUL\_low – FUL\_high | | | FDL\_low – FDL\_high | | |
| n2 | 1850 MHz | – | 1910MHz | 1930 MHz | – | 1990 MHz | FDD |
| n12 | 699 MHz | – | 716 MHz | 729 MHz | – | 746 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.90.1.2-1: Supported bandwidths per CA band combination of band n2+n12+n71

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n2A-n12A-n71A | CA\_n2A-n12A  CA\_n2A-n71A | n2 | 5, 10, 15, 20, 25, 30, 40 | 0 |
|  |  | n12 | 5, 10, 15 |  |
|  |  | n71 | 5, 10, 15, 20 |  |

#### 5.90.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n2A-n12A-n71A, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.90.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n2A-n12A-n71A | 0.3 | 1 | 1 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.90.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n2A-n12A-n71A | - | 0.8 | 0.8 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.90.2 Specific for 2 bands UL CA

#### 5.90.2.1 UE co-existence studies

UE co-existence has been already studied for 2DL/1UL fallback combinations: CA n2-n12 and CA\_n2-n71 and the impact of harmonic interference has been clarified. The own Rx impact of the 3rd band is shown as the followings:

– 5th order IMD generated by dual uplink of Band n71 + Band n2 may fall into own Rx of Band n12.

#### 5.90.2.2 REFSENS requirements

Table 5.90.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for DC\_2A-5A\_n71A are reused.

Table 5.90.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n2A-n12A-n71A | n2 | 1907.5 | 5 | 25 | 1987.5 | N/A | FDD | N/A |
|  | n12 | N/A | 5 | N/A | 743.5 | 4.2 | FDD | IMD5 |
|  | n71 | 665.5 | 5 | 25 | 649.5 | N/A | FDD | N/A |

## 5.91 CA\_n34-n39-n40

### 5.91.1 Common for 1 band UL and 2 bands UL CA

#### 5.91.1.1 Operating bands for CA

Table 5.91.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n34A-n39A-n40A | n34, n39, n40 |

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

Table 5.91.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n34A-n39A-n40A | CA\_n34A-n39A  CA\_n34A-n40A  CA\_n39A-n40A | n34 | 5, 10, 15 | 0 |
|  |  | n39 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | n40 | 5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 100 |  |
| CA\_n34A-n39A-n40A | CA\_n34A-n39A  CA\_n34A-n40A  CA\_n39A-n40A | n34 | See n34 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n39 | See n39 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n40 | See n40 channel bandwidths in Table 5.3.5-1 |  |

#### 5.91.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n34-n39-n40, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.91.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n34-n39-n40 | - | - | - |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.91.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n34-n39-n40 | 0.3 | 0.3 | 0.3 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.91.2 Specific for 2 bands UL CA

#### 5.91.2.1 UE co-existence studies

For the 2UL/3DL CA\_n34A-n39A-n40A in this TP, due to simultaneous Rx/Tx operation can be supported for the constitute band due to the fallbacks 2UL/2DL CA\_n34-n39, CA\_n34-n40 and CA\_n39-40 supports simultaneous Rx/Tx operation.

In terms of the co-existence study for the fallbacks of 2UL/2DL CA\_n34-n39, CA\_n34-n40 and CA\_n39-40:

IMD5 caused by UL CA\_n34-n39 may fall into n40 DL Rx range

No IMD issues caused by UL CA\_n34-n40 fall into n39 DL Rx range

No IMD issues caused by UL CA\_n39-n40 fall into n34 DL Rx range

#### 5.91.2.2 REFSENS requirements

Based on co-existence studies on 5.91.2.1, additional MSD is needed to be defined, shown in table 5.91.2.2-1.

**Table 5.91.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n34-n39-n40 | n34 | 2022.5 | 5 | 25 | 2022.5 | N/A | TDD | N/A |
|  | n39 | 1882.5 | 5 | 25 | 1882.5 | N/A | TDD | N/A |
|  | n40 | N/A | 5 | N/A | 2302.5 | 2.4 | TDD | IMD5 |

## 5.92 CA\_n3-n7-n20

### 5.92.1 Common for 1 band UL and 2 bands UL CA

#### 5.92.1.1 Operating bands for CA

Table 5.92.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n7-n20 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |

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

Table 5.92.1.2-1: Supported bandwidths per CA band combination of band n3+n7+n20

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n7A-n20A | CA\_n3A\_n7A  CA\_n3A\_n20A  CA\_n7A\_n20A | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n7 | See n7 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n20 | See n20 channel bandwidths in Table 5.3.5-1 |  |

#### 5.92.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n7-n20, the ΔTIB,c and ΔRIB,c values are reused from CA\_n3-n7-n26 and are given in the tables below.

Table 5.92.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n7-n20 | 0.5 | 0.5 | 0.3 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.92.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n7-n20 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.92.2 Specific for 2 bands UL CA

#### 5.92.2.1 UE co-existence studies

Co-existence studies shows that IMD2 caused by UL CA\_n3-n7 Tx might fall into band n20 Rx.

Co-existence studies shows that IMD2 and IMD3 caused by UL CA\_n3-n20 Tx might fall into band n7 Rx.

Co-existence studies shows that no IMD caused by UL CA\_n7-n20 fall into band n3 Rx.

#### 5.92.2.2 REFSENS requirements

IMD2 Band n20 Rx. MSD value reused from CA\_n3-n7-n28.

IMD2 Band n7 Rx. MSD value is reused from CA\_n3-n7-n26.

IMD3 Band n7 Rx. MSD value reused from CA\_n3-n7-n28.

Table 5.92.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n7-n20 | n3 | 1747 | 5 | 25 | 1842 | N/A | FDD | N/A |
|  | n7 | 2543 | 10 | 50 | 2663 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 796 | 20.0 | FDD | IMD2 |
|  | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
|  | n7 | N/A | 10 | N/A | 2625 | 29.0 | FDD | IMD2 |
|  | n20 | 845 | 5 | 25 | 804 | N/A | FDD | N/A |
|  | n3 | 1750 | 5 | 25 | 1845 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | 25 | N/A | 17.0 | FDD | IMD3 |
|  | n20 | 835 | 5 | 25 | 794 | N/A | FDD | N/A |

## 5.93 CA\_n3-n20-n78

### 5.93.1 Common for 1 band UL and 2 bands UL CA

#### 5.93.1.1 Operating bands for CA

Table 5.93.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n20-n78 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.93.1.2-1: Supported bandwidths per CA band combination of band n3+n20+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_ n3A-n20A-n78A | CA\_n3A-n20A CA\_n3A-n78A CA\_n20A-n78A | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n20 | See n20 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | See n78 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n3A-n20A-n78(2A) | CA\_n3A-n20A CA\_n3A-n78A CA\_n20A-n78A  CA\_n78(2A) | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n20 | See n20 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | CA\_n78(2A)\_BCS4 and 5 |  |

#### 5.93.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n20-n78, the ΔTIB,c and ΔRIB,c values are reused from DC\_3-20\_n78 and are given in the tables below.

Table 5.93.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n20-n78 | 0.5 | 0.3 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.93.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n20-n78 | 0.2 | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.93.2 Specific for 2 bands UL CA

#### 5.93.2.1 UE co-existence studies

Co-existence studies shows that IMD3 and IMD5 caused by UL CA\_n3-n20 Tx might fall into band n78 Rx.

Co-existence studies shows that there are no IMD caused by UL CA\_n3-n78 Tx fall into band n20 Rx.

Co-existence studies shows that IMD3 caused by UL CA\_n20-n78 Tx might fall into band n3 Rx.

The non-contiguous uplink IMD interference analysis has been completed in the fallback CA\_n3-n78(2A) with UL CA\_n78(2A) and in the fallback CA\_n20-n78(2A) with UL CA\_n78(2A). As was seen in these co-existence analyses, there are no IMD products from CA\_n78(2A) affecting band n3 DL and there are IMD4 and IMD6 products from CA\_n78(2A) affecting n20 DL.

#### 5.93.2.2 REFSENS requirements

The MSD value due to UL CA\_n78(2A) are defined in CA\_n20A-n78(2A).

The IMD4 and IMD6 MSD value due to UL CA\_n78(2A) are defined for CA\_n20-n78(2A).

MSD values for n78 is reused from DC\_3A\_n20A-n78A.

MSD values for n3 is reused from DC\_3A-20A\_n78A.

Table 5.93.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n20-n78 | n3 | 1730 | 5 | 25 | 1825 | N/A | FDD | N/A |
|  | n20 | 845 | 5 | 25 | 804 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3420 | 16.1 | TDD | IMD31 |
|  | n3 | N/A | 5 | N/A | 1820 | 17.3 | FDD | IMD3 |
|  | n20 | 845 | 5 | 25 | 804 | N/A | FDD | N/A |
|  | n78 | 3510 | 10 | 50 | 3510 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | | |

## 5.94 CA\_n7-n20-n67

### 5.94.1 Common for 1 band UL and 2 bands UL CA

#### 5.94.1.1 Operating bands for CA

Table 5.94.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n20-n67 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| n67 | N/A |  | N/A | 738 MHz | – | 758 MHz | SDL |

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

Table 5.94.1.2-1: Supported bandwidths per CA band combination of band n7+n20+n67

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n20A-n67A | CA\_n7A-n20A | n7 | See n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n20 | See n20 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n67 | See n67 channel bandwidths in Table 5.3.5-1 |  |

#### 5.94.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n20-n67, the ΔTIB,c values are reused from CA\_n7-n20 and are given in the tables below.

For CA\_n7-n20-n67, the ΔRIB,c values are reused from DC\_7-20\_n28 and are given in the tables below.

Table 5.94.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7-n20-n67 | 0.3 | 0.3 | - |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.94.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7-n20-n67 | - | 0.2 | 0.2 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.94.2 Specific for 2 bands UL CA

#### 5.94.2.1 UE co-existence studies

Co-existence studies shows that IMD5 caused by UL CA\_n7-n20 Tx might fall into band n67 Rx.

#### 5.94.2.2 REFSENS requirements

IMD5 Band n67 Rx. MSD value reused from CA\_n18-n28-n41. Test point used for band nn67 is a near miss.

Table 5.94.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n20-n67 | n7 | 2565 | 10 | 50 | 2685 | N/A | TDD | N/A |
|  | n20 | 834.5 | 5 | 25 | 793.5 | N/A | FDD | N/A |
|  | n67 | N/A | 5 | N/A | 773 | 3.9 | FDD | IMD5 |

## 5.95 CA\_n7-n20-n78

### 5.95.1 Common for 1 band UL and 2 bands UL CA

#### 5.95.1.1 Operating bands for CA

Table 5.95.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n7-n20-n78 | n7 | 2500 MHz | – | 2570 MHz | 2620 MHz | – | 2690 MHz | FDD |
| n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.95.1.2-1: Supported bandwidths per CA band combination of band n7+n20+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n7A-n20A-n78A | CA\_n7A-n20A CA\_n7A-n78A CA\_n20A-n78A | n7 | See n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n20 | See n20 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | See n78 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n7A-n20A-n78(2A) | CA\_n7A-n20A CA\_n7A-n78A CA\_n20A-n78A  CA\_n78(2A) | n7 | See n7 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n20 | See n20 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | CA\_n78(2A)\_BCS4 and 5 |  |

#### 5.95.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n7-n20-n78, the ΔTIB,c and ΔRIB,c values are reused from DC\_7-20\_n78 and are given in the tables below.

Table 5.95.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n7-n20-n78 | 0.3 | 0.3 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.95.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n7-n20-n78 | - | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.95.2 Specific for 2 bands UL CA

#### 5.95.2.1 UE co-existence studies

Co-existence studies shows that IMD2 and IMD4 caused by UL CA\_n7-n20 Tx might fall into band n78 Rx.

Co-existence studies shows that IMD2 and IMD5 caused by UL CA\_n7-n78 Tx might fall into band n20 Rx.

Co-existence studies shows that IMD2 caused by UL CA\_n20-n78 Tx might fall into band n7 Rx.

The non-contiguous uplink IMD interference analysis has been completed in the fallbacks CA\_n7-n78(2A) with UL CA\_n78(2A) and CA\_n20-n78(2A) with UL CA\_n78(2A). As was seen in these co-existence analyses, there are IMD5 products from CA\_n78(2A) affecting band n7 DL and there are IMD4 and IMD6 products from CA\_n78(2A) affecting n20 DL.

#### 5.95.2.2 REFSENS requirements

The MSD values due to UL CA\_n78(2A) are defined in CA\_n7A-n78(2A) and CA\_n20-n78(2A).

MSD values for n7 and n20 are reused from DC\_7A-20A\_n78A.

MSD values for n78 is reused from CA\_n7-n26-n78.

Table 5.95.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n7-n20-n78 | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 810 | 30.5 | FDD | IMD21 |
|  | n78 | 3370 | 10 | 50 | 3370 | N/A | TDD | N/A |
|  | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n20 | N/A | 5 | N/A | 810 | 3.0 | FDD | IMD5 |
|  | n78 | 3435 | 10 | 50 | 3435 | N/A | TDD | N/A |
|  | n7 | N/A | 5 | N/A | 2675 | 30.8 | FDD | IMD2 |
|  | n20 | 845 | 5 | 25 | 804 | N/A | FDD | N/A |
|  | n78 | 3520 | 10 | 50 | 3520 | N/A | TDD | N/A |
|  | n7 | 2540 | 5 | 25 | 2660 | N/A | FDD | N/A |
|  | n20 | 835 | 5 | 25 | 794 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3375 | 29.7 | TDD | IMD22 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified.  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.96 CA\_n20-n67-n78

### 5.96.1 Common for 1 band UL and 2 bands UL CA

#### 5.96.1.1 Operating bands for CA

Table 5.96.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n20-n67-n78 | n20 | 832 MHz | – | 862 MHz | 791 MHz | – | 821 MHz | FDD |
| n67 | N/A |  | N/A | 738 MHz | – | 758 MHz | SDL |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.96.1.2-1: Supported bandwidths per CA band combination of band n20+n67+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n20A-n67A-n78A | CA\_n20A\_n78A | n20 | See n20 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n67 | See n67 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | See n78 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n20A-n67A-n78(2A) | CA\_n20A\_n78A  CA\_n78(2A) | n20 | See n20 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n67 | See n67 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | CA\_n78(2A)\_BCS4 and 5 |  |

#### 5.96.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n20-n67-n78, the ΔTIB,c values are reused from DC\_20\_n78 and are given in the tables below.

For CA\_n20-n67-n78, the ΔRIB,c values are reused from DC\_20\_n28-n78 and are given in the tables below.

Table 5.96.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n20-n67-n78 | 0.6 | - | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.96.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n20-n67-n78 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.96.2 Specific for 2 bands UL CA

#### 5.96.2.1 UE co-existence studies

Co-existence studies shows that IMD4 caused by UL CA\_n20-n78 Tx might fall into band n67 Rx.

The non-contiguous uplink IMD interference analysis has been completed in the fallbacks CA\_n20A-n78(2A) with UL CA\_n78(2A) and CA\_n67A-n78(2A) with UL CA\_n78(2A). As was seen in these co-existence analyses, there are IMD4 products from CA\_n78(2A) affecting band n67 DL and there are IMD4 and IMD6 products from CA\_n78(2A) affecting n20 DL.

#### 5.96.2.2 REFSENS requirements

The MSD values due to UL CA\_n78(2A) are defined in CA\_n20A-n78(2A) and CA\_n67-n78(2A).

MSD need to be defined for IMD4 caused by UL CA\_n20-n78 Tx into band n67 Rx. MSD value is reused from CA\_n5-n14-n77.

Table 5.96.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n20-n67-n78 | n20 | 855 | 5 | 25 | 814 | N/A | FDD | N/A |
|  | n67 | N/A | 5 | N/A | 755 | 11.6 | FDD | IMD4 |
|  | n78 | 3320 | 10 | 50 | 3320 | N/A | TDD | N/A |

## 5.97 CA\_n5-n28-n79

### 5.97.1 Common for 1 band UL and 2 bands UL CA

#### 5.97.1.1 Operating bands for CA

Table 5.97.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n28-n79 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.97.1.2-1: Supported bandwidths per CA band combination of band n5+n28+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n28A-n79A | CA\_n5A\_n28A  CA\_n5A\_n79A  CA\_n28A\_n79A | n5 | See n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n28 | See n28 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |

#### 5.97.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5-n28-n79, the ΔTIB,c and ΔRIB,c values for CA\_n8-n28-n78 and CA\_n5-n28 are reused and are given in the tables below.

Table 5.97.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n28-n79 | 0.7 | 0.7 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.97.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n28-n79 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.97.2 Specific for 2 bands UL CA

#### 5.97.2.1 UE co-existence studies

Based on the co-existence studies, there is no own Rx impact of the 3rd band for this combination.

#### 5.97.2.2 REFSENS requirements

Based on studies in 5.97.2.1, no IMD interference falls into the own 3rd Rx frequency band, hence no need to define any MSD values.

## 5.98 CA\_n26-n70-n71

### 5.98.1 Common for 1 band UL and 2 bands UL CA

#### 5.98.1.1 Operating bands for CA

Table 5.98.1.1-1: 3DL Inter-band CA operating bands

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n26-n70-n71 | n26 | 814 MHz | – | 849 MHz | 859 MHz | – | 894 MHz | FDD |
| n70 | 1695 MHz | – | 1710 MHz | 1995 MHz | – | 2020 MHz | FDD |
| n71 | 663 MHz | – | 698 MHz | 617 MHz | – | 652 MHz | FDD |

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

Table 5.98.1.2-1: Supported bandwidths per CA band combination of band n26+n70+n71

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n26A-n70A-n71A | CA\_n26A-n70A  CA\_n70A-n71A | n26 | 5, 10, 15, 20 | 0 |
|  |  | n70 | 5, 10, 15, 20, 25 |  |
|  |  | n71 | 5, 10, 15, 20 |  |

#### 5.98.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n26-n70-n71, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.98.1.3-1: ΔTIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n26-n70-n71 | 0.5 | 0.3 | 0.6 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.98.1.3-2: ΔRIB,c

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n26-n70-n71 | 0.5 | - | 0.3 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.98.2 Specific for 2 bands UL CA

#### 5.98.2.1 UE co-existence studies

Based on the co-existence studies, it can be observed:

No IMD issue caused by n26+n70 falls into band n71 Rx;

No IMD issue caused by n70+n71 falls into band n26 Rx;

#### 5.98.2.2 REFSENS requirements

Based on co-existence studies on 5.98.2.1, no need to define exceptional REFSENS requirements.

## 5.99 CA\_n1-n5-n79

### 5.99.1 Common for 1 band UL and 2 bands UL CA

#### 5.99.1.1 Operating bands for CA

Table 5.99.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n5-n79 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.99.1.2-1: Supported bandwidths per CA band combination of band n1+n5+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n5A-n79A | CA\_n1A\_n5A  CA\_n1A\_n79A  CA\_n5A\_n79A | n1 | See n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n5 | See n5 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |

#### 5.99.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n5-n79, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n5-n78 and are given in the tables below.

Table 5.99.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n5-n79 | 0.6 | 0.6 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.99.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n5-n79 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.99.2 Specific for 2 bands UL CA

#### 5.99.2.1 UE co-existence studies

Co-existence studies shows that IMD3 and IMD4 caused by UL CA\_n1-n5 Tx may fall into band n79 Rx.

Co-existence studies shows that IMD3 and IMD4 caused by UL CA\_n1-n79 Tx may fall into band n5 Rx.

Co-existence studies shows that IMD4 caused by UL CA\_n5-n79 Tx may fall into band n1 Rx.

#### 5.99.2.2 REFSENS requirements

Table 5.99.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n1A-n28A-n79A and CA\_n3-n28-n79 are reused

Table 5.99.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n5-n79 | n1 | N/A | 5 | N/A | 2160 | 1.2 | FDD | IMD4 |
|  | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n79 | 4650 | 40 | 100 | 4650 | N/A | TDD | N/A |
|  | n1 | 1930 | 5 | 25 | 2120 | N/A | FDD | N/A |
|  | n5 | N/A | 5 | N/A | 890 | 15.2 | FDD | IMD3 |
|  | n79 | 4750 | 40 | 100 | 4750 | N/A | TDD | N/A |
|  | n1 | 1923 | 5 | 25 | 2113 | N/A | FDD | N/A |
|  | n5 | N/A | 5 | N/A | 879 | 10.3 | FDD | IMD4 |
|  | n79 | 4890 | 40 | 100 | 4890 | N/A | TDD | N/A |
|  | n1 | 1970 | 5 | 25 | 2160 | N/A | FDD | N/A |
|  | n5 | 845 | 5 | 25 | 890 | N/A | FDD | N/A |
|  | n79 | N/A | 40 | N/A | 4785 | 14.9 | TDD | IMD3 |
|  | n1 | 1940 | 5 | 25 | 2130 | N/A | FDD | N/A |
|  | n5 | 830 | 5 | 25 | 874 | N/A | FDD | N/A |
|  | n79 | N/A | 40 | N/A | 4430 | 9.4 | TDD | IMD4 |

## 5.100 CA\_n3-n5-n28

### 5.100.1 Common for 1 band UL and 2 bands UL CA

#### 5.100.1.1 Operating bands for CA

Table 5.100.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n5-n28 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 804 MHz | FDD |

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

Table 5.100.1.2-1: Supported bandwidths per CA band combination of band n3+n5+n28

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n5A-n28A | CA\_n3A-n5A  CA\_n3A-n28A  CA\_n5A-n28A | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n5 | See n5 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n28 | See n28 channel bandwidths in Table 5.3.5-1 |  |

#### 5.100.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n5-n28, the ΔTIB,c and ΔRIB,c values are already included in specification for 1 band UL.

### 5.100.2 Specific for 2 bands UL CA

#### 5.100.2.1 UE co-existence studies

Co-existence studies shows that IMD4 caused by UL CA\_n3-n5 Tx may fall into band n28 Rx.

Co-existence studies shows that IMD4 caused by UL CA\_n5-n28 Tx may fall into band n3 Rx.

#### 5.100.2.2 REFSENS requirements

Table 5.100.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for DC\_3A-28A\_n5A are reused.

Table 5.100.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n5-n28 | n3 | N/A | 5 | N/A | 1829.5 | 8.7 | FDD | IMD4 |
|  | n5 | 845 | 5 | 25 | 890 | N/A | FDD | N/A |
|  | n28 | 705.5 | 5 | 25 | 760.5 | N/A | FDD | N/A |
|  | n3 | 1713 | 5 | 25 | 1808 | N/A | FDD | N/A |
|  | n5 | 827 | 5 | 25 | 872 | N/A | FDD | N/A |
|  | n28 | N/A | 5 | N/A | 768 | 9.4 | FDD | IMD4 |

## 5.101 CA\_n3-n5-n79

### 5.101.1 Common for 1 band UL and 2 bands UL CA

#### 5.101.1.1 Operating bands for CA

Table 5.101.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n3-n5-n79 | n3 | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.101.1.2-1: Supported bandwidths per CA band combination of band n3+n5+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n3A-n5A-n79A | CA\_n3A-n5A  CA\_n3A-n79A  CA\_n5A-n79A | n3 | See n3 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n5 | See n5 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |

#### 5.101.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n3-n5-n79, the ΔTIB,c and ΔRIB,c values are reused from CA\_n3-n28-n79 and are given in the tables below.

Table 5.101.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n3-n5-n79 | 0.3 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.101.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n3-n5-n79 | - | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.101.2 Specific for 2 bands UL CA

#### 5.101.2.1 UE co-existence studies

Co-existence studies shows that IMD3 and IMD4 caused by UL CA\_n3-n5 Tx may fall into band n79 Rx.

Co-existence studies shows that IMD3 and IMD4 caused by UL CA\_n3-n79 Tx may fall into band n5 Rx.

Co-existence studies shows that IMD4 caused by UL CA\_n5-n79 Tx may fall into band n3 Rx.

#### 5.101.2.2 REFSENS requirements

Table 5.101.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n3A-n8A-n79A and CA\_n3-n28-n79 are reused.

Table 5.101.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n3-n5-n79 | n3 | N/A | 5 | N/A | 1877.5 | 8.8 | FDD | IMD4 |
|  | n5 | 846.5 | 5 | 25 | 891.5 | N/A | FDD | N/A |
|  | n79 | 4420 | 40 | 216 | 4420 | N/A | TDD | N/A |
|  | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
|  | n5 | N/A | 5 | N/A | 860 | 15.3 | FDD | IMD3 |
|  | n79 | 4420 | 40 | 216 | 4420 | N/A | TDD | N/A |
|  | n3 | 1770 | 5 | 25 | 1865 | N/A | FDD | N/A |
|  | n5 | N/A | 5 | N/A | 890 | 10.3 | FDD | IMD4 |
|  | n79 | 4420 | 40 | 216 | 4420 | N/A | TDD | N/A |
|  | n3 | 1782.5 | 5 | 25 | 1875.5 | N/A | FDD | N/A |
|  | n5 | 846.5 | 5 | 25 | 891.5 | N/A | FDD | N/A |
|  | n79 | N/A | 40 | N/A | 4420 | 15.7 | TDD | IMD3 |
|  | n3 | 1780 | 5 | 25 | 1875 | N/A | FDD | N/A |
|  | n5 | 846 | 5 | 25 | 891 | N/A | FDD | N/A |
|  | n79 | N/A | 40 | N/A | 4494 | 9.4 | TDD | IMD4 |

## 5.102 CA\_n5-n78-n79

### 5.102.1 Common for 1 band UL and 2 bands UL CA

#### 5.102.1.1 Operating bands for CA

Table 5.102.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n78-n79 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n79 | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |

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

Table 5.102.1.2-1: Supported bandwidths per CA band combination of band n5+n78+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n78A-n79A | CA\_n5A-n78A  CA\_n5A-n79A  CA\_n78A-n79A | n5 | See n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n78 | See n78 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |

#### 5.102.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5-n78-n79, the ΔTIB,c and ΔRIB,c values are reused from CA\_n28-n78-n79 and are given in the tables below.

Table 5.102.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n78-n79 | 0.5 | 0.8 / 1.57 | 0.5 / 1.57 |
| NOTE 7: The requirements only apply for UE supporting inter-band carrier aggregation with simultaneous Rx/Tx capability, and NR UL carrier frequencies are confined to 3700 MHz-3800MHz for n78 and 4400 MHz-4500MHz for n79. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.  NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.102.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n78-n79 | 0.2 | 0.5 | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.102.2 Specific for 2 bands UL CA

#### 5.102.2.1 UE co-existence studies

Co-existence studies shows that IMD2, IMD3, IMD4 and IMD5 caused by UL CA\_n5-n78 Tx may fall into band n79 Rx.

Co-existence studies shows that IMD2 and IMD3 caused by UL CA\_n5-n79 Tx may fall into band n78 Rx.

Co-existence studies shows that IMD2 and IMD5 caused by UL CA\_n78-n79 Tx may fall into band n5 Rx.

#### 5.102.2.2 REFSENS requirements

Table 5.102.2.2-1 lists the MSD required for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n28-n46-n78 and CA\_n28-n78-n79 are reused.

Table 5.102.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n5-n78-n79 | n5 | 846 | 5 | 25 | 891 | N/A | FDD | N/A |
|  | n78 | 3790 | 10 | 50 | 3790 | N/A | TDD | N/A |
|  | n79 | N/A | 40 | N/A | 4636 | 26.2 | TDD | IMD2 |
|  | n5 | 827 | 5 | 25 | 872 | N/A | FDD | N/A |
|  | n78 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
|  | n79 | N/A | 40 | N/A | 4959 | 22 | TDD | IMD3 |
|  | n5 | 827 | 5 | 25 | 872 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3593 | 26.9 | TDD | IMD2 |
|  | n79 | 4420 | 40 | 216 | 4420 | N/A | TDD | N/A |
|  | n5 | 827 | 5 | 25 | 872 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3326 | 17 | TDD | IMD3 |
|  | n79 | 4980 | 40 | 216 | 4980 | N/A | TDD | N/A |
|  | n5 | N/A | 5 | N/A | 880 | 16.2 | FDD | IMD2 |
|  | n78 | 3550 | 10 | 50 | 3550 | N/A | TDD | N/A |
|  | n79 | 4430 | 40 | 216 | 4430 | N/A | TDD | N/A |
|  | n5 | N/A | 5 | N/A | 875 | 3 | FDD | IMD5 |
|  | n78 | 3305 | 10 | 50 | 3305 | N/A | TDD | N/A |
|  | n79 | 4520 | 40 | 216 | 4520 | N/A | TDD | N/A |

## 5.103 CA\_n5-n28-n78

### 5.103.1 Common for 1 band UL and 2 bands UL CA

#### 5.103.1.1 Operating bands for CA

Table 5.103.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n5-n28-n78 | n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |
| n78 | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |

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

Table 5.103.1.2-1: Supported bandwidths per CA band combination of band n5+n28+n78

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n28A-n78A | CA\_n5A-n28A  CA\_n5A-n78A  CA\_n28A-n78A | n5 | See n5 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n28 | See n28 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n78 | See n78 channel bandwidths in Table 5.3.5-1 |  |

#### 5.103.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5-n28-n78, the ΔTIB,c and ΔRIB,c values are reused from DC\_18-28\_n78 and are given in the tables below.

Table 5.x.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n28-n78 | 0.7 | 0.7 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.x.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n28-n78 | 0.2 | 0.2 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.103.2 Specific for 2 bands UL CA

#### 5.103.2.1 UE co-existence studies

Co-existence studies shows that IMD5 caused by UL CA\_n5-n28 Tx may fall into band n78 Rx.

Co-existence studies shows that IMD4 caused by UL CA\_n5-n78 Tx may fall into band n28 Rx.

Co-existence studies shows that IMD5 caused by UL CA\_n28-n78 Tx may fall into band n5 Rx.

#### 5.103.2.2 REFSENS requirements

Band n5 Rx. MSD value reused from DC\_18-28\_n78.

Band n28 Rx. MSD value reused from DC\_8\_n28-n78.

Band n78 Rx MSD value reused from DC\_18-28\_n78.

Table 5.103.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n5-n28-n78 | n5 | N/A | 5 | N/A | 874 | 3.8 | FDD | IMD5 |
|  | n28 | 723 | 5 | 25 | 778 | N/A | FDD | N/A |
|  | n78 | 3766 | 10 | 50 | 3756 | N/A | TDD | N/A |
|  | n5 | 844 | 5 | 25 | 889 | N/A | FDD | N/A |
|  | n28 | N/A | 5 | N/A | 778 | 11.6 | FDD | IMD4 |
|  | n78 | 3310 | 10 | 50 | 3310 | N/A | TDD | N/A |
|  | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n28 | 707 | 5 | 25 | 762 | N/A | FDD | N/A |
|  | n78 | N/A | 10 | N/A | 3781 | 4.0 | TDD | IMD5 |

## 5.104 CA\_n34-n39-n41

### 5.104.1 Common for 1 band UL and 2 bands UL CA

#### 5.104.1.1 Operating bands for CA

Table 5.104.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n34-n39-n41 | n34, n39, n41 |

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

Table 5.104.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n34A-n39A-n41A | CA\_n34A-n39A  CA\_n34A-n41A  CA\_n39A-n41A | n34 | See n34 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n39 | See n39 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n41 | See n41 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n34A-n39A-n41C | CA\_n34A-n39A  CA\_n34A-n41A  CA\_n39A-n41A | n34 | See n34 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n39 | See n39 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n41 | CA\_n41C\_BCS 4 and 5 |  |

#### 5.104.1.3 ∆TIB,c and ∆RIB,c values

The ΔTIB,c and ΔRIB,c values are defined in the following:

Table 5.104.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| Inter-band CA combination | ΔTIB,c for NR bands (dB)8 | | |
| Component band in order of bands in configuration9 | | |
| n34-n39-n41 | 0.3 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.104.1.3-1: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| Inter-band CA combination | ΔRIB,c for NR bands (dB)9 | | |
| Component band in order of bands in configuration10 | | |
| n34-n39-n41 | 0.3 | 0.3 | 0.2 |
| NOTE 9: “-” denotes ΔTIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

### 5.104.2 Specific for 2 bands UL CA

#### 5.104.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n34A-n39A, CA\_n34A-n41A and CA\_n39A-n41A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

No IMD issues caused by n39+n41 fall into the its own band n34 Rx;

No IMD issues caused by n34+n41 fall into the its own band n39 Rx;

No IMD issues caused by n34+n39 fall into the its own band n41 Rx.

#### 5.104.2.2 REFSENS requirements

Based on co-existence studies, there are no additional MSD needed to be defined

## 5.105 CA\_n34-n40-n41

### 5.105.1 Common for 1 band UL and 2 bands UL CA

#### 5.105.1.1 Operating bands for CA

Table 5.105.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n34-n40-n41 | n34, n40, n41 |

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

Table 5.105.1.2-1: Supported bandwidths per CA band combination of band nX+nY+nZ

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n34A-n40A-n41A | CA\_n34A-n40A  CA\_n34A-n41A  CA\_n40A-n41A | n34 | See n34 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n40 | See n40 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n41 | See n41 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n34A-n40A-n41C | CA\_n34A-n40A  CA\_n34A-n41A  CA\_n40A-n41A | n34 | See n34 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n40 | See n40 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n41 | CA\_n41C\_BCS 4 and 5 |  |

#### 5.105.1.3 ∆TIB,c and ∆RIB,c values

The ΔTIB,c and ΔRIB,c values are defined in the following:

Table 5.105.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| Inter-band CA combination | ΔTIB,c for NR bands (dB)8 | | |
| Component band in order of bands in configuration9 | | |
| CA\_n34-n40-n41 | 0.3 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.105.1.3-1: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| Inter-band CA combination | ΔRIB,c for NR bands (dB)9 | | |
| Component band in order of bands in configuration10 | | |
| CA\_n34-n40-n41 | 0.3 | 0.3 | - |
| NOTE 9: “-” denotes ΔTIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

### 5.105.2 Specific for 2 bands UL CA

#### 5.105.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n34A-n40A, CA\_n34A-n41A and CA\_n40A-n41A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD3 and IMD5 issue caused by n40+n41 fall into the its own band n34 Rx;

No IMD issues caused by n34+n41 fall into the its own band n40 Rx;

IMD3 issue caused by n34+n40 fall into the its own band n41 Rx.

#### 5.105.2.2 REFSENS requirements

Based on co-existence studies additional MSD is needed to be defined, shown in table 5.105.2.2-1.

Table 5.105.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| CA\_n34-n40-n41 | n34 | N/A | 5 | N/A | 2015 | 18.3 | IMD31 |
|  | n40 | 2302.5 | 5 | 25 | 2302.5 | N/A | N/A |
|  | n41 | 2590 | 10 | 50 | 2590 | N/A | IN/A |
|  | n34 | 2020 | 5 | 25 | 2020 | N/A | N/A |
|  | n40 | 2320 | 5 | 25 | 2320 | N/A | N/A |
|  | n41 | 2620 | 10 | 50 | 2620 | 16.5 | IMD3 |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

## 5.106 CA\_n34-n41-n79

### 5.106.1 Common for 1 band UL and 2 bands UL CA

#### 5.106.1.1 Operating bands for CA

Table 5.106.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |
| --- | --- |
| NR CA Band | NR Band  (Table 5.2-1) |
| CA\_n34-n41-n79 | n34, n41, n79 |

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

Table 5.106.1.2-1: Supported bandwidths per CA band combination of band n34+n41+n79

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n34A-n41A-n79A | CA\_n34A-n41A  CA\_n34A-n79A  CA\_n41A-n79A | n34 | See n34 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | See n41 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |
| CA\_n34A-n41C-n79A | CA\_n34A-n41A  CA\_n34A-n79A  CA\_n41A-n79A | n34 | See n34 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | CA\_n41C\_BCS 4 and 5 |  |
|  |  | n79 | See n79 channel bandwidths in Table 5.3.5-1 |  |

#### 5.106.1.3 ∆TIB,c and ∆RIB,c values

The ΔTIB,c and ΔRIB,c values are defined in the following:

Table 5.106.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| Inter-band CA combination | ΔTIB,c for NR bands (dB)8 | | |
| Component band in order of bands in configuration9 | | |
| n34-n41-n79 | 0.3 | 0.5 | 0.8 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.106.1.3-1: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| Inter-band CA combination | ΔRIB,c for NR bands (dB)9 | | |
| Component band in order of bands in configuration10 | | |
| n34-n41-n79 | - | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔTIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

### 5.106.2 Specific for 2 bands UL CA

#### 5.106.2.1 UE co-existence studies

The co-existence for the fallback 2DL/2UL of CA\_n34A-n41A, CA\_n34A-n79A and CA\_n41A-n79A have already been analyzed. In terms of the co-existence studies of corresponding fallbacks, it can be observed:

IMD2 caused by 2UL n34+n41 may fall into the its own band n79 Rx

IMD2 caused by 2UL n34+n79 may fall into the its own band n41 Rx

IMD2 and IMD5 caused by 2UL n41+n79 may fall into the its own band n34 Rx

#### 5.106.2.2 REFSENS requirements

Based on co-existence studies additional MSD is needed to be defined, shown in table 5.106.2.2-1.

Table 5.106.2.2-1: 3DL/2UL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | IMD order |
| CA\_n34-n41-n79 | n34 | 2020 | 5 | 25 | 2020 | N/A | N/A |
|  | n41 | 2660 | 5 | 25 | 2660 | N/A | N/A |
|  | n79 | 4680 | 40 | 216 | 4680 | 19.3 | IMD2 |
|  | n34 | 2020 | 5 | 25 | 2020 | N/A | N/A |
|  | n41 | 2550 | 5 | 25 | 2550 | 27.2 | IMD2 |
|  | n79 | 4570 | 40 | 216 | 4570 | N/A | IN/A |
|  | n34 | 2015 | 5 | 25 | 2015 | 28.6 | IMD2 |
|  | n41 | 2585 | 5 | 25 | 2585 | N/A | N/A |
|  | n79 | 4600 | 40 | 216 | 4600 | N/A | N/A |
|  | n34 | 2015 | 5 | 25 | 2015 | 7.5 | IMD5 |
|  | n41 | 2515 | 5 | 25 | 2515 | N/A | N/A |
|  | n79 | 4780 | 40 | 216 | 4780 | N/A | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified. | | | | | | | |

## 5.107 CA\_n1-n5-n28

### 5.107.1 Common for 1 band UL and 2 bands UL CA

#### 5.107.1.1 Operating bands for CA

Table 5.107.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n5-n28 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n28 | 703 MHz | – | 748 MHz | 758 MHz | – | 803 MHz | FDD |

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

Table 5.107.1.2-1: Supported bandwidths per CA band combination of band n1+n5+n28

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n1A-n5A-n28A | CA\_n1A-n5A  CA\_n1A-n28A  CA\_n5A-n28A | n1 | See n1 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n5 | See n5 channel bandwidths in Table 5.3.5-1 |  |
|  |  | n28 | See n28 channel bandwidths in Table 5.3.5-1 |  |

#### 5.107.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n5-n28, the ΔTIB,c and ΔRIB,c values are reused from CA\_n1-n18-n28 and CA\_n5-n28 and are given in the tables below.

Table 5.107.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n5-n28 | 0.3 | 0.7 | 0.7 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.107.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n5-n28 | - | 0.2 | 0.2 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.107.2 Specific for 2 bands UL CA

#### 5.107.2.1 UE co-existence studies

Co-existence studies shows that IMD caused by UL CA\_n1-n5 Tx don’t fall into band n28 Rx.

Co-existence studies shows that IMD5 caused by UL CA\_n1-n28 Tx may fall into band n5 Rx.

Co-existence studies shows that IMD5 caused by UL CA\_n5-n28 Tx may fall into band n1 Rx.

#### 5.107.2.2 REFSENS requirements

Band n1 Rx. MSD value reused from CA\_n1-n18-n28.

Band n5 Rx. MSD value reused from CA\_n1-n18-n28.

Table 5.107.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n1-n5-n28 | n1 | N/A | 5 | N/A | 2123 | 4 | FDD | IMD5 |
|  | n5 | 829 | 5 | 25 | 874 | N/A | FDD | N/A |
|  | n28 | 738 | 5 | 25 | 793 | N/A | FDD | N/A |
|  | n1 | 1965 | 5 | 25 | 2155 | N/A | FDD | N/A |
|  | n5 | N/A | 5 | N/A | 875 | 4.6 | FDD | IMD5 |
|  | n28 | 710 | 5 | 25 | 765 | N/A | FDD | N/A |

## 5.108 CA\_n1-n5-n40

### 5.108.1 Common for 1 band UL and 2 bands UL CA

#### 5.108.1.1 Operating bands for CA

**Table 5.108.1.1-1: 3DL Inter-band CA operating bands**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR CA Band** | **NR Band** | **Uplink (UL) operating band** | | | **Downlink (DL) operating band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| CA\_n1-n5-n40 | n1 | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n5 | 824 MHz | – | 849 MHz | 869 MHz | – | 894 MHz | FDD |
| n40 | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |

5.108.1.2 Channel bandwidths per operating band for CA

**Table 5.108.1.2-1: Supported bandwidths per CA band combination of band n1+n5+n40**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **NR CA configuration** | **Uplink CA configuration or single uplink carrier** | **NR Band** | **Channel bandwidth (MHz)** | **Bandwidth combination set** |
| CA\_n1A-n5A-n40A | CA\_n1A-n5A  CA\_n1A-n40A  CA\_n5A-n40A | n1 | 5, 10, 15, 20 | 0 |
|  |  | n5 | 5, 10, 15, 20 |  |
|  |  | n40 | 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |

5.108.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n1-n5-n40, the ΔTIB,c and ΔRIB,c values are given in the tables below, which is reused from DC\_1-5\_n40

**Table 5.108.1.3-1: ΔTIB,c**

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n1-n5-n40 | 0.6 | 0.3 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

**Table 5.108.1.3-2: ΔRIB,c**

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n1-n5-n40 | - | 0.2 | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

5.108.2 Specific for 2 bands UL CA

5.108.2.1 UE co-existence studies

Based on the calculation:

- IMD4 of dual UL n1 and n5 falls into n40 DL

- IMD4 of dual UL n1 and n40 falls into n5 DL

- IMD5 of dual UL n5 and n40 falls into n1 DL

5.108.2.2 REFSENS requirements

Based on co-existence studies on 5.108.2.1, there is a need to define MSD values. MSD values from DC\_1-5\_n40 and DC\_1\_n5-n40 are reused as below.

**Table 5.108.2.2-1: MSD for the CA configuration**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Band / Channel bandwidth / NRB / Duplex mode** | | | | | | | | **Source of IMD** |
| **NR CA band combination** | **NR band** | **UL Fc  (MHz)** | **UL/DL BW  (MHz)** | **UL  CLRB** | **DL Fc (MHz)** | **MSD  (dB)** | **Duplex mode** |  |
| CA\_n1-n5-n40 | n1 | N/A | 5 | N/A | 2144 | 4.0 | FDD | IMD5 |
|  | n5 | 832 | 5 | 25 | 877 | N/A | FDD | N/A |
|  | n40 | 2320 | 5 | 25 | 2320 | N/A | TDD | N/A |
|  | n1 | 1945 | 5 | 25 | 2135 | N/A | FDD | N/A |
|  | n5 | N/A | 5 | N/A | 880 | 8.0 | FDD | IMD4 |
|  | n40 | 2385 | 5 | 25 | 2385 | N/A | TDD | N/A |
|  | n1 | 1977.5 | 5 | 25 | 2167.5 | N/A | FDD | N/A |
|  | n5 | 826.5 | 5 | 25 | 871.5 | N/A | FDD | N/A |
|  | n40 | N/A | 5 | N/A | 2305 | 9.0 | TDD | IMD4 |

## 5.109 CA\_n5-n7-n25

### 5.109.1 Common for 1 band UL and 2 bands UL CA

#### 5.109.1.1 Operating bands for CA

Table 5.109.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| NR Band | Uplink (UL) band | Downlink (DL) band | Duplex  mode |
| BS receive / UE transmit | BS transmit / UE receive |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| n5 | 824 MHz – 849 MHz | 869 MHz – 894 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n25 | 1850 MHz – 1915 MHz | 1930 MHz – 1995 MHz | FDD |

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

Table 5.109.1.2-1: Supported bandwidths per CA band combination of band n5+n7+n25

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n7A-n25A | CA\_n5A-n7A  CA\_n5A-n25A  CA\_n7A-n25A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 |  |
|  |  | n25 | 5, 10, 15, 20, 25, 30, 35, 40, 45 |  |
| CA\_n5A-n7A-n25(2A) | CA\_n5A-n7A  CA\_n5A-n25A  CA\_n7A-n25A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 |  |
|  |  | n25 | CA\_n25(2A) |  |

#### 5.109.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5A-n7A-n25A, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.109.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n7-n25 | 0.3 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.109.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n7-n25 | - | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.109.2 Specific for 2 bands UL CA

#### 5.109.2.1 UE co-existence studies

Table 5.109.2.1-1 lists Band n5 + Band n7 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.109.2.1-2 lists Band n5 + Band n25 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.109.2.1-3 lists Band n7 + Band n25 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Based on Table 5.109.2.1-1, it can be seen that:

- IMD3 of band n5 UL and band n7 UL falls into band n5 DL

- IMD5 of band n5 UL and n7 UL falls into band n5 DL

- IMD5 of band n5 UL and n7 UL falls into band n7 DL

Based on Table 5.109.2.1-2, it can be seen that

- IMD2 of band n5 UL and n25 UL falls into band n7 DL.

Based on Table 5.109.2.1-3, it can be seen that no harmonic or IMD issues from UL CA\_n7-n5.

**Table 5.109.2.1-1: Band n5 and Band n7 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 2620 | 2690 |
| 3rd Band DL | 1930 | 1995 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 2500 | 2570 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 7500 | 7710 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 10000 | 10280 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 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) | 1651 | 1746 | 3324 | 3419 |
| 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) | 922 | 802 | 4151 | 4316 |
| 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) | 4148 | 4268 | 5824 | 5989 |
| 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) | 98 | 47 | 6651 | 6886 |
| 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) | 4972 | 5117 | 8324 | 8559 |
| 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) | 3492 | 3302 | 6648 | 6838 |
| 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) | 9456 | 9151 | 896 | 726 |
| 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) | 6062 | 5802 | 2453 | 2668 |
| 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) | 10824 | 11129 | 5796 | 5966 |
| 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) | 9148 | 9408 | 7472 | 7687 |

**Table 5.109.2.1-2: Band n5 and Band n25 UL harmonics and IMD products**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |  |
| DL frequency (MHz) | 869 | 894 | 1930 | 1995 |  |
| 3rd Band DL | 2620 | 2690 |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 1850 | 1915 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 3700 | 3830 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 5550 | 5745 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 7400 | 7660 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 9250 | 9575 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1001 | 1091 | 2674 | 2764 |
| 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) | 267 | 152 | 2851 | 3006 |
| 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) | 3498 | 3613 | 4524 | 4679 |
| 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) | 557 | 697 | 4701 | 4921 |
| 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) | 4322 | 4462 | 6374 | 6594 |
| 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) | 2182 | 2002 | 5348 | 5528 |
| 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) | 6836 | 6551 | 1546 | 1381 |
| 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) | 4097 | 3852 | 1153 | 1358 |
| 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) | 8224 | 8509 | 5146 | 5311 |
| 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) | 7198 | 7443 | 6172 | 6377 |

**Table 5.109.2.1-3: Band n7 and Band n25 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 2620 | 2690 | 1930 | 1995 |
| 3rd Band DL | 869 | 894 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2500 | 2570 | 1850 | 1915 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 5000 | 5140 | 3700 | 3830 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7500 | 7710 | 5550 | 5745 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 10000 | 10280 | 7400 | 7660 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 12500 | 12850 | 9250 | 9575 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 720 | 585 | 4350 | 4485 |
| 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) | 3085 | 3290 | 1130 | 1330 |
| 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) | 6850 | 7055 | 6200 | 6400 |
| 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) | 5585 | 5860 | 2980 | 3245 |
| 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) | 9350 | 9625 | 8050 | 8315 |
| 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) | 1170 | 1440 | 8700 | 8970 |
| 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) | 5160 | 4830 | 8430 | 8085 |
| 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) | 745 | 410 | 4010 | 3670 |
| 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) | 9900 | 10230 | 11850 | 12195 |
| 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) | 10550 | 10885 | 11200 | 11540 |

#### 5.109.2.2 REFSENS requirements

Table 5.109.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n2-n5-n41 are reused.

Table 5.109.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n5-n7-n25 | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2685 | 30.0 | FDD | IMD2 |
|  | n25 | 1855 | 5 | 25 | 1935 | N/A | FDD | N/A |

## 5.110 CA\_n5-n7-n66

### 5.110.1 Common for 1 band UL and 2 bands UL CA

#### 5.110.1.1 Operating bands for CA

Table 5.110.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| NR Band | Uplink (UL) band | Downlink (DL) band | Duplex  mode |
| BS receive / UE transmit | BS transmit / UE receive |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| n5 | 824 MHz – 849 MHz | 869 MHz – 894 MHz | FDD |
| n7 | 2500 MHz – 2570 MHz | 2620 MHz – 2690 MHz | FDD |
| n66 | 1710 MHz – 1780 MHz | 2110 MHz – 2200 MHz | FDD |

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

Table 5.110.1.2-1: Supported bandwidths per CA band combination of band n5+n7+n25

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n7A-n66A | CA\_n5A-n7A  CA\_n5A-n66A  CA\_n7A-n66A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n7 | 5, 10, 15, 20, 25, 30, 35, 40, 50 |  |
|  |  | n66 | 5, 10, 15, 20, 25, 30, 35, 40, 45 |  |

#### 5.110.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5A-n7A-n66A, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.110.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n7-n66 | 0.3 | 0.5 | 0.5 |
| NOTE 8: “-” denotes ΔTIB,c = 0.  NOTE 9: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n5 the band order from left to right is n1, n3 and n5. | | | |

Table 5.110.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n7-n66 | - | 0.5 | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.110.2 Specific for 2 bands UL CA

#### 5.110.2.1 UE co-existence studies

Table 5.110.2.1-1 lists Band n5 + Band n7 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.110.2.1-2 lists Band n5 + Band n66 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.110.2.1-3 lists Band n7 + Band n66 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Based on Table 5.110.2.1-1, it can be seen that there is no impact on the 3rd RX band.

Based on Table 5.x.2.1-2, it can be seen that the IMD2, IMD3 and IMD5 of band n5 UL and n66 UL falls into band n7 DL

 Based on Table 5.110.2.1-3, it can be seen that the IMD3 of band n7 UL and n66 UL falls into band n5 DL

**Table 5.110.2.1-1: Band n5 and Band n7 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 2620 | 2690 |
| 3rd Band DL | 2110 | 2200 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 2500 | 2570 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 5000 | 5140 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 7500 | 7710 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 10000 | 10280 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 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) | 1651 | 1746 | 3324 | 3419 |
| 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) | 922 | 802 | 4151 | 4316 |
| 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) | 4148 | 4268 | 5824 | 5989 |
| 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) | 98 | 47 | 6651 | 6886 |
| 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) | 4972 | 5117 | 8324 | 8559 |
| 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) | 3492 | 3302 | 6648 | 6838 |
| 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) | 9456 | 9151 | 896 | 726 |
| 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) | 6062 | 5802 | 2453 | 2668 |
| 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) | 10824 | 11129 | 5796 | 5966 |
| 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) | 9148 | 9408 | 7472 | 7687 |

**Table 5.110.2.1-2: Band n5 and Band n66 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 2110 | 2200 |
| 3rd Band DL | 2620 | 2690 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 6840 | 7120 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 8550 | 8900 |
| 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 | |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) | 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 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) | 3692 | 3432 | 873 | 1088 |
| 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) | 7664 | 7969 | 5006 | 5176 |
| 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 |

**Table 5.110.2.1-3: Band n7 and Band n66 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 2620 | 2690 | 2110 | 2200 |
| 3rd Band DL | 869 | 894 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2500 | 2570 | 1710 | 1780 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 5000 | 5140 | 3420 | 3560 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7500 | 7710 | 5130 | 5340 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 10000 | 10280 | 6840 | 7120 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 12500 | 12850 | 8550 | 8900 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 860 | 720 | 4210 | 4350 |
| 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) | 3220 | 3430 | 850 | 1060 |
| 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) | 6710 | 6920 | 5920 | 6130 |
| 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) | 5720 | 6000 | 2560 | 2840 |
| 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) | 9210 | 9490 | 7630 | 7910 |
| 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) | 1440 | 1720 | 8420 | 8700 |
| 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) | 4620 | 4270 | 8570 | 8220 |
| 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) | 340 | 10 | 4290 | 3940 |
| 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) | 9340 | 9690 | 11710 | 12060 |
| 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) | 10130 | 10480 | 10920 | 11270 |

#### 5.110.2.2 REFSENS requirements

Table 5.110.2.2-1 lists the MSD required for the dual connectivity configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. The MSD values for CA\_n5-n41-n66 are reused for IMD2.

Table 5.110.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n5-n7-n66 | n5 | 846.5 | 5 | 25 | 891.5 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2624 | 29.0 | FDD | IMD2 |
|  | n66 | 1777.5 | 5 | 25 | 2177.5 | N/A | FDD | N/A |
|  | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n7 | N/A | 5 | N/A | 2670 | 13 | FDD | IMD3 |
|  | n66 | 1750 | 5 | 25 | 2150 | N/A | FDD | N/A |
|  | n5 | N/A | 5 | N/A | 880 | 13 | FDD | IMD3 |
|  | n7 | 2560 | 5 | 25 | 2680 | N/A | FDD | N/A |
|  | n66 | 1720 | 5 | 25 | 2120 | N/A | FDD | N/A |

## 5.111 CA\_n5-n25-n41

### 5.111.1 Common for 1 band UL and 2 bands UL CA

#### 5.111.1.1 Operating bands for CA

Table 5.111.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| NR Band | Uplink (UL) band | Downlink (DL) band | Duplex  mode |
| BS receive / UE transmit | BS transmit / UE receive |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| n5 | 824 MHz – 849 MHz | 869 MHz – 894 MHz | FDD |
| n25 | 1850 MHz – 1915 MHz | 1930 MHz – 1995 MHz | FDD |
| n41 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 MHz | TDD |

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

Table 5.111.1.2-1: Supported bandwidths per CA band combination of band n5+n25+n41

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n25A-n41A | CA\_n5A-n25A  CA\_n5A-n41A  CA\_n25A-n41A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n25 | 5, 10, 15, 20, 25, 30, 35, 40, 45 |  |
|  |  | n41 | 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 |  |
| CA\_n5A-n25(2A)-n41A | CA\_n5A-n25A  CA\_n5A-n41A  CA\_n25A-n41A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n25 | CA\_n25(2A) |  |
|  |  | n41 | 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 |  |

#### 5.111.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5A-n7A-n41A, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.111.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n25-n41 | 0.6 | 0.5 | 0.45 / 0.96 |
| NOTE 5: The requirement is applied for UE transmitting on the frequency range of 2545 - 2690 MHz.  NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2496 - 2545 MHz. | | | |

Table 5.111.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n25-n41 | 0.2 | - | - |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.111.2 Specific for 2 bands UL CA

#### 5.111.2.1 UE co-existence studies

Table 5.111.2.1-1 lists Band n5 + Band n25 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.111.2.1-2 lists Band n5 + Band n41 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.111.2.1-3 lists Band n25 + Band n41 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Based on Table 5.111.2.1-1, it can be seen that IMD2 of band n5 UL and n25 UL falls into band n41 DL

**Table 5.111.2.1-1: Band n5 and Band n25 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 1930 | 1995 |
| 3rd Band DL | 2496 | 2690 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 1850 | 1915 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 3700 | 3830 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 5550 | 5745 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 7400 | 7660 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 9250 | 9575 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1001 | 1091 | 2674 | 2764 |
| 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) | 267 | 152 | 2851 | 3006 |
| 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) | 3498 | 3613 | 4524 | 4679 |
| 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) | 557 | 697 | 4701 | 4921 |
| 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) | 4322 | 4462 | 6374 | 6594 |
| 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) | 2182 | 2002 | 5348 | 5528 |
| 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) | 6836 | 6551 | 1546 | 1381 |
| 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) | 4097 | 3852 | 1153 | 1358 |
| 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) | 8224 | 8509 | 5146 | 5311 |
| 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) | 7198 | 7443 | 6172 | 6377 |

**Table 5.111.2.1-2: Band n5 and Band n41 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 2496 | 2690 |
| 3rd Band DL | 1930 | 1995 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 2496 | 2690 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 4992 | 5380 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 7488 | 8070 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 9984 | 10760 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 12480 | 13450 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1647 | 1866 | 3320 | 3539 |
| 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) | 1042 | 798 | 4143 | 4556 |
| 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) | 4144 | 4388 | 5816 | 6229 |
| 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) | 218 | 51 | 6639 | 7246 |
| 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) | 4968 | 5237 | 8312 | 8919 |
| 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) | 3732 | 3294 | 6640 | 7078 |
| 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) | 9936 | 9135 | 900 | 606 |
| 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) | 6422 | 5790 | 2445 | 2908 |
| 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) | 10808 | 11609 | 5792 | 6086 |
| 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) | 9136 | 9768 | 7464 | 7927 |

**Table 5.111.2.1-3: Band n25 and Band n41 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 1930 | 1995 | 2496 | 2690 |
| 3rd Band DL | 869 | 894 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1850 | 1915 | 2496 | 2690 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3700 | 3830 | 4992 | 5380 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5550 | 5745 | 7488 | 8070 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 7400 | 7660 | 9984 | 10760 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 9250 | 9575 | 12480 | 13450 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 581 | 840 | 4346 | 4605 |
| 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) | 1010 | 1334 | 3077 | 3530 |
| 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) | 6196 | 6520 | 6842 | 7295 |
| 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) | 2860 | 3249 | 5573 | 6220 |
| 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) | 8046 | 8435 | 9338 | 9985 |
| 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) | 1680 | 1162 | 8692 | 9210 |
| 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) | 8910 | 8069 | 5164 | 4710 |
| 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) | 4370 | 3658 | 753 | 170 |
| 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) | 11834 | 12675 | 9896 | 10350 |
| 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) | 11188 | 11900 | 10542 | 11125 |

#### 5.111.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. Table 5.111.2.2-1 lists the MSD required for the CA configuration for the cases that IMD interference fall into the own 3rd Rx frequency band. MSD values from CA\_n2-n5-n41 are reused.

Table 5.111.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n5-n25-n41 | n5 | 830 | 5 | 25 | 875 | N/A | FDD | N/A |
|  | n25 | 1855 | 5 | 25 | 1935 | N/A | FDD | N/A |
|  | n41 | N/A | 5 | N/A | 2685 | 30.0 | TDD | IMD2 |

## 5.112 CA\_n5-n41-n77

### 5.112.1 Common for 1 band UL and 2 bands UL CA

#### 5.112.1.1 Operating bands for CA

Table 5.112.1.1-1: Inter-band CA operating bands involving FR1 (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| NR Band | Uplink (UL) band | Downlink (DL) band | Duplex  mode |
| BS receive / UE transmit | BS transmit / UE receive |
| FUL\_low – FUL\_high | FDL\_low – FDL\_high |
| n5 | 824 MHz – 849 MHz | 869 MHz – 894 MHz | FDD |
| n41 | 2496 MHz – 2690 MHz | 2496 MHz – 2690 MHz | TDD |
| n77 | 3300 MHz – 4200 MHz | 3300 MHz – 4200 MHz | TDD |

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

Table 5.112.1.2-1: Supported bandwidths per CA band combination of band n5+n41+n77

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n5A-n41A-n77A | CA\_n5A-n41A  CA\_n5A-n77A  CA\_n41A-n77A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n41 | 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 |  |
|  |  | n77 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |  |
| CA\_n5A-n41A-n77(2A) | CA\_n5A-n41A  CA\_n5A-n77A  CA\_n41A-n77A | n5 | 5, 10, 15, 20, 25 | 0 |
|  |  | n41 | 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 |  |
|  |  | n77 | CA\_n77(2A) |  |

#### 5.112.1.3 ∆TIB,c and ∆RIB,c values

For CA\_n5-n41-n77, the ΔTIB,c and ΔRIB,c values are given in the tables below.

Table 5.112.1.3-1: ΔTIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔTIB,c for NR bands (dB)8** | | |
| **Component band in order of bands in configuration9** | | |
| CA\_n5-n41-n77 | 0.6 | 0.3 | 0.8 |
| NOTE 5: The requirement is applied for UE transmitting on the frequency range of 2545 - 2690 MHz.  NOTE 6: The requirement is applied for UE transmitting on the frequency range of 2496 - 2545 MHz. | | | |

Table 5.112.1.3-2: ΔRIB,c due to NR CA (three bands)

|  |  |  |  |
| --- | --- | --- | --- |
| **Inter-band CA combination** | **ΔRIB,c for NR bands (dB)9** | | |
| **Component band in order of bands in configuration10** | | |
| CA\_n5-n41-n77 | 0.2 | - | 0.5 |
| NOTE 9: “-” denotes ΔRIB,c = 0.  NOTE 10: The component band order in the configuration should be listed by the order of NR bands, such as for CA\_n1-n3-n8 the band order from left to right is n1, n3 and n8. | | | |

### 5.112.2 Specific for 2 bands UL CA

#### 5.112.2.1 UE co-existence studies

Table 5.112.2.1-1 lists Band n5 + Band n41 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.112.2.1-2 lists Band n5 + Band n77 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Table 5.112.2.1-3 lists Band n41 + Band n77 2UL bands CA 2nd, 3rd, 4th and 5th order IMD for the UE coexistence analysis.

Based on Table 5.112.2.1-1, it can be seen that:

- IMD2, IMD3 and IMD4 of band n5 UL and band n41 UL falls into band n77 DL

Based on Table 5.112.2.1-2, it can be seen that

- IMD2 and IMD3 of band n5 UL and n77 UL falls into band n41 DL

Based on Table 5.112.2.1-3, it can be seen that

- IMD2 and IMD3 of band n41 UL and n77 UL falls into band n5 DL

**Table 5.112.2.1-1: Band n5 and Band n41 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 2496 | 2690 |
| 3rd Band DL | 3300 | 4200 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 2496 | 2690 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 4992 | 5380 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 7488 | 8070 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 9984 | 10760 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 12480 | 13450 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 1647 | 1866 | 3320 | 3539 |
| 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) | 1042 | 798 | 4143 | 4556 |
| 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) | 4144 | 4388 | 5816 | 6229 |
| 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) | 218 | 51 | 6639 | 7246 |
| 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) | 4968 | 5237 | 8312 | 8919 |
| 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) | 3732 | 3294 | 6640 | 7078 |
| 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) | 9936 | 9135 | 900 | 606 |
| 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) | 6422 | 5790 | 2445 | 2908 |
| 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) | 10808 | 11609 | 5792 | 6086 |
| 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) | 9136 | 9768 | 7464 | 7927 |

**Table 5.112.2.1-2: Band n5 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 869 | 894 | 3300 | 4200 |
| 3rd Band DL | 2496 | 2690 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 824 | 849 | 3300 | 4200 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1648 | 1698 | 6600 | 8400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2472 | 2547 | 9900 | 12600 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 3296 | 3396 | 13200 | 16800 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 4120 | 4245 | 16500 | 21000 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2451 | 3376 | 4124 | 5049 |
| 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) | 2552 | 1602 | 5751 | 7576 |
| 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) | 4948 | 5898 | 7424 | 9249 |
| 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) | 1728 | 753 | 9051 | 11776 |
| 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) | 5772 | 6747 | 10724 | 13449 |
| 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) | 6752 | 4902 | 8248 | 10098 |
| 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) | 15976 | 12351 | 96 | 904 |
| 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) | 10952 | 8202 | 4053 | 5928 |
| 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) | 14024 | 17649 | 6596 | 7596 |
| 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) | 11548 | 14298 | 9072 | 10947 |

**Table 5.112.2.1-3: Band n41 and Band n77 UL harmonics and IMD products**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE DL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| DL frequency (MHz) | 2496 | 2690 | 3300 | 4200 |
| 3rd Band DL | 869 | 894 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2496 | 2690 | 3300 | 4200 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 4992 | 5380 | 6600 | 8400 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7488 | 8070 | 9900 | 12600 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | 4\* fy\_low | 4\* fy\_high |
| 4th harmonics frequency limits (MHz) | 9984 | 10760 | 13200 | 16800 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | 5\* fy\_low | 5\* fy\_high |
| 5th harmonics frequency limits (MHz) | 12480 | 13450 | 16500 | 21000 |
| 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 610 | 1704 | 5796 | 6890 |
| 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) | 792 | 2080 | 3910 | 5904 |
| 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) | 8292 | 9580 | 9096 | 11090 |
| 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) | 3288 | 4770 | 7210 | 10104 |
| 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) | 10788 | 12270 | 12396 | 15290 |
| 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) | 3408 | 1220 | 11592 | 13780 |
| 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) | 14304 | 10510 | 7460 | 5784 |
| 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) | 7608 | 4520 | 1470 | 912 |
| 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) | 4908 | 7220 | 888 | 330 |
| 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) | 15696 | 19490 | 13284 | 14960 |
| 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) | 14892 | 17980 | 14088 | 16470 |

#### 5.112.2.2 REFSENS requirements

Based on the co-existence studies there are a need to define MSD values. Table 5.112.2.2-1 lists the MSD required for the CA configuration for the cases that IMD interference fall into the own 3rd Rx frequency band.

For IMD2 of band n5 UL and band n41 UL falls into band n77 DL，MSD values from CA\_n5-n7-n78 are reused.

For IMD3 of band n5 UL and band n41 UL falls into band n77 DL，MSD values from CA\_n5-n30-n77 are reused.

For IMD2 of band n5 UL and band n77 UL falls into band n41 DL，MSD values from CA\_n5-n7-n77 are reused.

For IMD3 of band n5 UL and band n77 UL falls into band n41 DL，MSD values from CA\_n5-n30-n77 are reused.

For IMD2 of band n41 UL and band n77 UL falls into band n5 DL，MSD values from CA\_n5-n7-n77 are reused.

For IMD3 of band n41 UL and band n77 UL falls into band n5 DL，MSD values from CA\_n5-n30-n77 are reused.

Table 5.112.2.2-1: MSD for the CA configuration

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode | Source of IMD |
| CA\_n5-n41-n77 | n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
|  | n41 | 2540 | 5 | 25 | 2540 | N/A | TDD | N/A |
|  | n77 | N/A | 10 | N/A | 3375 | 29.7 | TDD | IMD22 |
|  | n5 | 840 | 5 | 25 | 885 | N/A | FDD | N/A |
|  | n41 | 2500 | 5 | 25 | 2500 | N/A | TDD | N/A |
|  | n77 | N/A | 10 | N/A | 4160 | 16.1 | TDD | IMD3 |
|  | n5 | 844 | 5 | 25 | 889 | N/A | FDD | N/A |
|  | n41 | N/A | 5 | N/A | 2645 | 30.1 | TDD | IMD2 |
|  | n77 | 3489 | 10 | 50 | 3489 | N/A | TDD | N/A |
|  | n5 | 835 | 5 | 25 | 880 | N/A | FDD | N/A |
|  | n41 | N/A | 5 | N/A | 2510 | 13.2 | FDD | IMD3 |
|  | n77 | 4180 | 10 | 50 | 4180 | N/A | TDD | N/A |
|  | n5 | N/A | 5 | N/A | 879 | 30.2 | FDD | IMD2 |
|  | n41 | 2550 | 5 | 25 | 2550 | N/A | TDD | N/A |
|  | n77 | 3429 | 10 | 50 | 3429 | N/A | TDD | N/A |
|  | n5 | N/A | 5 | N/A | 900 | 15.2 | FDD | IMD31 |
|  | n41 | 2500 | 5 | 25 | 2500 | N/A | TDD | N/A |
|  | n77 | 4100 | 10 | 50 | 4100 | N/A | TDD | N/A |
| NOTE 1: This band is subject to IMD5 also which MSD is not specified  NOTE 2: This band is subject to IMD4 also which MSD is not specified. | | | | | | | | |

## 5.113 CA\_n25-n41-n66

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table 5.x.1.2-1: Supported bandwidths per CA band combination of band n25+n41+n66NR CA configuration | | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n25A-n41C-n66A | n417,9  CA\_n25A-n41A7  CA\_n25A-n66A  CA\_n41A-n66A7  CA\_n41C7  CA\_n25A-n41C  CA\_n41C-n66A | | n25 | 5, 10, 15, 20 | 0 |
|  |  | | n41 | CA\_n41C\_BCS0 |  |
|  |  | | n66 | 5, 10, 15, 20, 40 |  |
|  |  | | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | | n41 | CA\_n41C\_BCS1 |  |
|  |  | | n66 | 5, 10, 15, 20, 25, 30, 40 |  |
|  |  | | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | | n41 | CA\_n41C BCS 4 and 5 |  |
|  |  | | n66 | n66 channel bandwidths in Table 5.3.5-1 |  |

### 5.113.2 Specific for 2 bands UL CA

#### 5.113.2.1 UE co-existence studies

Based on Table 5.113.2.1-1, 3rd order IMD from band n25 and Band n41 may also fall into Rx frequencies of band n66.

Table 5.113.2.1-1 lists Band n25A + Band n41C 2UL bands CA 1st order triple beat (IMD3) related to 2UL band 3CC (one band support intra-band ULCA) for the UE-to-UE coexistence analysis into the third receive band of Band n66, where Band n41C is the uplink band supporting two uplink carriers and Band n25 is the single uplink carrier.

**Table 5.113.2.1-1: Band n25 and Band n41 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 2496 | 2506 | 2686 | 2690 |  | 10 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 1850 | 1915 | 2680 | 2500 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 1660 | 1860 | 1905 | 2105 |  | 190 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 3087 | 3520 | 6852 | 7285 |  |  |

Based on Table 5.113.2.1-1, 1st order triple beat IMD is falling inside band n66.

Based on Table 5.113.2.1-2, 3rd order IMD from band n41 and Band n66 may also fall into Rx frequencies of band n25.

Table 5.113.2.1-2 lists Band n66A + Band n41C 2UL bands CA 1st order triple beat (IMD3) related to 2UL band 3CC (one band support intra-band ULCA) for the UE-to-UE coexistence analysis into the third receive band of Band n25, where Band n41C is the uplink band supporting two uplink carriers and Band n66 is the single uplink carrier.

**Table 5.113.2.1-2: Band n41 and Band n66 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 2496 | 2506 | 2686 | 2690 |  | 10 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 1710 | 1780 | 2680 | 2500 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 1520 | 1720 | 1770 | 1970 |  | 190 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 3222 | 3660 | 6712 | 7150 |  |  |

Based on Table 5.113.2.1-2, 1st order triple beat IMD is falling inside band n25.

#### 5.113.2.2 REFSENS requirements

Based on the triple beat analysis of the added ULCA Table 5.113.2.2-1 has been added with the additional REFSENS requirements.

Table 5.113.2.2-1: 3DL/2UL inter-band Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  CLRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
| CA\_n25-n41-n66 | n25 | N/A | 5 | 25 | 1950 | 15.3 | FDD | IMD3 |
|  | n41 | 2546 | 100 | 1 (RBstart=24) | 2546 | N/A | TDD | N/A |
|  |  | 2641 | 90 | 1 (RBstart=232) | 2641 |  |  |  |
|  | n66 | 1775 | 5 | 25 | 2195 | N/A | FDD | N/A |
|  | n25 | 1912.5 | 5 | 25 | 1992.5 | N/A | FDD | N/A |
|  | n41 | 2546 | 100 | 1 (RBstart=260) | 2546 | N/A | TDD | N/A |
|  |  | 2641 | 90 | 1 (RBstart=121) | 2641 |  |  |  |
|  | n66 | N/A | 5 | 25 | 1962.5 | 15.3 | FDD | IMD3 |

## 5.114 CA\_n25-n41-n71

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 5.x.1.2-1: Supported bandwidths per CA band combination of band n25+n41+n71NR CA configuration | Uplink CA configuration or single uplink carrier | NR Band | Channel bandwidth (MHz) | Bandwidth combination set |
| CA\_n25A-n41C-n71A | n417,9  CA\_n25A-n41A7  CA\_n25A-n71A  CA\_n41A-n71A7  CA\_n41C7 | n25 | 5, 10, 15, 20 | 0 |
|  | CA\_n25A-n41C  CA\_n41C-n71A | n41 | CA\_n41C\_BCS0 |  |
|  |  | n71 | 5, 10, 15, 20 |  |
|  |  | n25 | 5, 10, 15, 20, 25, 30, 40 | 1 |
|  |  | n41 | CA\_n41C\_BCS1 |  |
|  |  | n71 | 5, 10, 15, 20 |  |
|  |  | n25 | n25 channel bandwidths in Table 5.3.5-1 | 4 and 5 |
|  |  | n41 | CA\_n41C BCS 4 and 5 |  |
|  |  | n71 | n71 channel bandwidths in Table 5.3.5-1 |  |

### 5.114.2 Specific for 2 bands UL CA

#### 5.114.2.1 UE co-existence studies

Based on Table 5.114.2.1-1, nth order IMD from band n25 and Band n41 may also fall into Rx frequencies of band n71.

Table 5.114.2.1-1 lists Band n25A + Band n41C 2UL bands CA 1st order triple beat (IMD3) related to 2UL band 3CC (one band support intra-band ULCA) for the UE-to-UE coexistence analysis into the third receive band of Band n71, where Band n41C is the uplink band supporting two uplink carriers and Band n25 is the single uplink carrier.

**Table 5.114.2.1-1: Band n25 and Band n41 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 2496 | 2506 | 2686 | 2690 |  | 10 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 1850 | 1915 | 2680 | 2500 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 1660 | 1860 | 1905 | 2105 |  | 190 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 3087 | 3520 | 6852 | 7285 |  |  |

Based on Table 5.114.2.1-1, 1st order triple beat IMD there is no products falling inside band n71.

Based on Table 5.114.2.1-2, nth order IMD from band n41 and Band n71 may also fall into Rx frequencies of band n25.

Table 5.114.2.1-2 lists Band n71A + Band n41C 2UL bands CA 1st order triple beat (IMD3) related to 2UL band 3CC (one band support intra-band ULCA) for the UE-to-UE coexistence analysis into the third receive band of Band n25, where Band n41C is the uplink band supporting two uplink carriers and Band n71 is the single uplink carrier.

**Table 5.114.2.1-2: Band n41 and Band n71 triple beat IMD products**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CC location | fU1L | fU2L | fU3L | fU1H |  | CBW |
| Frequency | 2496 | 2506 | 2686 | 2690 |  | 10 |
| CC location | fSCCL | fSCCH | fU2H | fU3H |  | Min ch. separation |
| Frequency | 663 | 698 | 2680 | 2500 |  | 0 |
| 1st order TB | IfU3L -fU1L- fSCCL| | IfU2L -fU1L + fSCCL| | IfU2L -fU1L- fSCCH| | IfU3L -fU1L + fSCCH| |  | Max ch. separation |
| Ranges | 473 | 673 | 688 | 888 |  | 190 |
| 1st order TB | IfU2L+fU1L-fSCCH| | IfU1H+fU2H-fSCCL| | IfU2L +fU1L+fSCCL| | IfU1H +fU2H+fSCCH| |  |  |
| Ranges | 4304 | 4707 | 5665 | 6068 |  |  |

Based on Table 5.114.2.1-2, 1st order triple beat IMD there is no products falling inside band n25.

#### 5.114.2.2 REFSENS requirements

Based on the triple beat analysis of the added ULCA there is no additional REFSEN requirements.

# 6 Dual Connectivity: Specific Band Combination Part

## 6.x DC\_nX-nY-nZ

Editor’s note: The texts for NR DC can only be added associated with the texts for the corresponding inter-band 2 bands UL CA above, which means pure TP to TR to included NR DC configuration is not allowed.

### 6.x.1 Configurations for DC\_nX-nY-nZ

Table 6.x.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_nXA-nYA-nZ | DC\_nXA-nYA  DC\_nXA-nZA  DC\_nYA-nZA |

## 6.1 DC\_n3-n67-n78

### 6.1.1 Configurations for DC\_n3-n67-n78

Table 6.1.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n3A-n67A-n78A  DC\_n3A-n67A-n78(2A) | DC\_n3A-n78A |

## 6.2 DC\_n3-n7-n67

### 6.2.1 Configurations for DC\_n3-n7-n67

Table 6.2.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n3A-n7A-n67A | DC\_n3A-n7A |

## 6.3 DC\_n1-n28-n46

### 6.3.1 Configurations for DC\_n1-n28-n46

**Table 6.3.1-1: Inter-band NR DC configurations (three bands)**

| **NR DC**  **configuration** | **Uplink NR DC**  **configuration** |
| --- | --- |
| DC\_n1A-n28A-n46A  DC\_n1A-n28A-n46C  DC\_n1A-n28A-n46D  DC\_n1A-n28A-n46(2A) | DC\_n1A-n46A  DC\_n28A-n46A |

## 6.4 DC\_n1-n46-n78

### 6.4.1 Configurations for DC\_n1-n46-n78

**Table 6.4.1-1: Inter-band NR DC configurations (three bands)**

| **NR DC**  **configuration** | **Uplink NR DC**  **configuration** |
| --- | --- |
| DC\_n1A-n46A-n78A  DC\_n1A-n46C-n78A  DC\_n1A-n46D-n78A  DC\_n1A-n46A-n78(2A)  DC\_n1A-n46C-n78(2A)  DC\_n1A-n46D-n78(2A)  DC\_n1A-n46(2A)-n78A  DC\_n1A-n46(2A)-n78(2A) | DC\_n1A-n46A  DC\_n1A-n78A  DC\_n46A-n78A |

## 6.5 DC\_n1-n7-n67

### 6.5.1 Configurations for DC\_n1-n7-n67

Table 6.5.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n1A-n7A-n67A | DC\_n1A-n7A |

## 6.6 DC\_n1-n67-n78

### 6.6.1 Configurations for DC\_n1-n67-n78

Table 6.6.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n1A-n67A-n78A | DC\_n1A-n78A |
| DC\_n1A-n67A-n78(2A) | DC\_n1A-n78A |

## 6.7 DC\_n7-n67-n78

### 6.7.1 Configurations for DC\_n7-n67-n78

Table 6.7.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n7A-n67A-n78A | DC\_n7A-n78A |
| DC\_n7A-n67A-n78(2A) | DC\_n7A-n78A |

## 6.8 DC\_n1-n28-n102

### 6.8.1 Configurations for DC\_n1-n28-n102

Table 6.8.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n1A-n28A-n102A  DC\_n1A-n28A-n102B  DC\_n1A-n28A-n102C  DC\_n1A-n28A-n102D  DC\_n1A-n28A-n102E | DC\_n1A-n102A  DC\_n1A-n102B  DC\_n1A-n102C  DC\_n28A-n102A  DC\_n28A-n102B  DC\_n28A-n102C |
| DC\_n1A-n28A-n102(2A) | DC\_n1A-n102A  DC\_n28A-n102A |

## 6.9 DC\_n1-n78-n102

### 6.9.1 Configurations for DC\_n1-n78-n102

Table 6.9.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n1A-n78A-n102A  DC\_n1A-n78A-n102B  DC\_n1A-n78A-n102C  DC\_n1A-n78A-n102D  DC\_n1A-n78A-n102E | DC\_n1A-n78A DC\_n1A-n102A  DC\_n1A-n102B  DC\_n1A-n102C DC\_n78A-n102A  DC\_n78A-n102B  DC\_n78A-n102C |
| DC\_n1A-n78(2A)-n102A  DC\_n1A-n78(2A)-n102B  DC\_n1A-n78(2A)-n102C  DC\_n1A-n78(2A)-n102D  DC\_n1A-n78(2A)-n102E  DC\_n1A-n78A-n102(2A)  DC\_n1A-n78(2A)-n102(2A) | DC\_n1A-n78A DC\_n1A-n102A  DC\_n1A-n102B  DC\_n1A-n102C DC\_n78A-n102A  DC\_n78A-n102B  DC\_n78A-n102C |

## 6.10 DC\_n7-n78-n102

### 6.10.1 Configurations for DC\_n7-n78-n102

Table 6.10.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n7A-n78A-n102A  DC\_n7A-n78A-n102B  DC\_n7A-n78A-n102C  DC\_n7A-n78A-n102D  DC\_n7A-n78A-n102E | DC\_n7A-n78A  DC\_n7A-n102A  DC\_n7A-n102B  DC\_n7A-n102C  DC\_n78A-n102A  DC\_n78A-n102B  DC\_n78A-n102C |
| DC\_n7A-n78(2A)-n102A  DC\_n7A-n78(2A)-n102B  DC\_n7A-n78(2A)-n102C  DC\_n7A-n78(2A)-n102D  DC\_n7A-n78(2A)-n102E  DC\_n7A-n78A-n102(2A)  DC\_n7A-n78(2A)-n102(2A) | DC\_n7A-n78A  DC\_n7A-n102A  DC\_n7A-n102B  DC\_n7A-n102C  DC\_n78A-n102A  DC\_n78A-n102B  DC\_n78A-n102C |

## 6.11 DC\_n28-n78-n102

### 6.11.1 Configurations for DC\_n28-n78-n102

Table 6.11.1-1: Inter-band NR DC configurations

| NR DC  Configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n28A-n78A-n102A  DC\_n28A-n78A-n102B  DC\_n28A-n78A-n102C  DC\_n28A-n78A-n102D  DC\_n28A-n78A-n102E | DC\_n28A-n78A DC\_n28A-n102A  DC\_n28A-n102B  DC\_n28A-n102C DC\_n78A-n102A  DC\_n78A-n102B  DC\_n78A-n102C |
| DC\_n28A-n78(2A)-n102A  DC\_n28A-n78(2A)-n102B  DC\_n28A-n78(2A)-n102C  DC\_n28A-n78(2A)-n102D  DC\_n28A-n78(2A)-n102E  DC\_n28A-n78A-n102(2A)  DC\_n28A-n78(2A)-n102(2A) | DC\_n28A-n78A DC\_n28A-n102A  DC\_n28A-n102B  DC\_n28A-n102C DC\_n78A-n102A  DC\_n78A-n102B  DC\_n78A-n102C |

## 6.12 DC\_ n3-n7-n20

### 6.12.1 Configurations for DC\_n3-n7-n20

Table 6.12.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n3A-n7A-n20A | DC\_n3A\_n7A  DC\_n3A\_n20A  DC\_n7A\_n20A |

## 6.13 DC\_ n3-n20-n78

### 6.13.1 Configurations for DC\_n3-n20-n78

Table 6.13.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n3A-n20A-n78A | DC\_n3A-n20A  DC\_n3A-n78A  DC\_n20A-n78A |
| DC\_n3A-n20A-n78(2A) | DC\_n3A-n20A  DC\_n3A-n78A  DC\_n20A-n78A |

## 6.14 DC\_ n7-n20-n67

### 6.14.1 Configurations for DC\_n7-n20-n67

Table 6.14.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_ n7A-n20A-n67A | DC\_n7A-n20A |

## 6.15 DC\_ n7-n20-n78

### 6.15.1 Configurations for DC\_n7-n20-n78

Table 6.15.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_ n7A-n20A-n78A | DC\_n7A-n20A DC\_n7A-n78A DC\_n20A-n78A |
| DC\_ n7A-n20A-n78(2A) | DC\_n7A-n20A DC\_n7A-n78A DC\_n20A-n78A |

## 6.16 DC\_ n20-n67-n78

### 6.16.1 Configurations for DC\_n20-n67-n78

Table 6.16.1-1: Inter-band NR DC configurations

| NR DC  configuration | Uplink NR DC  configuration |
| --- | --- |
| DC\_n20A-n67A-n78A | DC\_n20A\_n78A |
| DC\_n20A-n67A-n78(2A) | DC\_n20A\_n78A |

Annex <X> (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Change history | | | | | | | |
| Date | Meeting | Tdoc | CR | Rev | Cat | Subject/Comment | New version |
| 2022-08 | RAN4 #104-e | R4-2213383 |  |  |  | TR skeleton | 0.0.0 |
| 2022-08 | RAN4 #104-e | R4-2213384 |  |  |  | 1. R4-2212449, TP for TR 38.xxx-xx-xx: CA\_n1-n41-n79, SoftBank Corp., LG Electronics  2. R4-2212456, TP for TR 38.xxx-xx-xx: CA\_n41-n77-n79, SoftBank Corp., LG Electronics  3. R4-2212545, TP for TR 38.XXX-XX-XX: CA\_n3A-n28A-n40A, Samsung, KDDI  4. R4-2212725, TP for TR38.xxx-xx-xx\_3DL/2UL CA\_n3A-n8A-n41A, ZTE Corporation  5. R4-2213107, TP for TR 38.818-03-01: CA\_n1-n3-n26, Ericsson, Telstra  6. R4-2213109, TP for TR 38.818-03-01: CA\_n1-n26-n78, Ericsson, Telstra  7. R4-2213111, TP for TR 38.818-03-01: CA\_n3-n26-n78, Ericsson, Telstra  8. R4-2213108, TP for TR 38.818-03-01: CA\_n1-n7-n26, Ericsson, Telstra  9. R4-2213110, TP for TR 38.818-03-01: CA\_n3-n7-n26, Ericsson, Telstra  10. R4-2213112, TP for TR 38.818-03-01: CA\_n7-n26-n78, Ericsson, Telstra | 0.1.0 |
| 2022-10 | RAN4 #104-bis-e | R4-2216720 |  |  |  | 1. R4-2215444, TP for TR 38.718-03-01: CA\_n41-n77-n79, SoftBank Corp.  2. R4-2216627, TP for TR 38.718-03-01 on table templates and error corrections, ZTE Corporation  3. R4-2217043, TP for TR 38.718-03-01: CA\_n3-n41-n79, SoftBank Corp.  4. R4-2217045, TP for TR 38.718-03-01: CA\_n29-n70-n71, DISH Network, Samsung  5. R4-2217046, TP for TR 38.718-03-01: CA\_n48-n71-n77, DISH Network, Samsung  6. R4-2217048, TP for TR 38.718-03-01 to introduce CA\_n1-n3-n38, Huawei, HiSilicon  7. R4-2217049, TP for TR 38.718-03-01 to introduce CA\_n1A-n7A-n38A and CA\_n1(2A)-n7A-n38A, Huawei, HiSilicon  8. R4-2217050, TP for TR 38.718-03-01 to introduce CA\_n3A-n7A-n38A, CA\_n3B-n7A-n38A and CA\_n3(2A)-n7A-n38A, Huawei, HiSilicon  9. R4-2217051, TP for TR 38.718-03-01 to introduce CA\_n3-n78-n79, Huawei, HiSilicon | 0.2.0 |
| 2022-11 | RAN4 #105 | R4-2219763 |  |  |  | 1. R4-2219090, TP to TR 38.717-03-01: Addition of CA\_n5-n7-n77, Nokia, Bell, Telus  2. R4-2219091, TP to TR 38.717-03-01: Addition of CA\_n7-n71-n77, Nokia, Bell, Telus  3. R4-2220793, TP for TR 38.718-03-01: CA\_n48-n70-n77, DISH Network, Samsung  4. R4-2220794, TP for TR 38.718-03-01: CA\_n66-n70-n77, DISH Network, Samsung  5. R4-2220795, TP for TR 38.718-03-01: CA\_n70-n71-n77, DISH Network, Samsung  6. R4-2220796, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n1-n3-n38, Ericsson  7. R4-2220797, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n1-n7-n38, Ericsson  8. R4-2220799, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n3-n28-n38, Ericsson  9. R4-2220800, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n7-n28-n38, Ericsson  10. R4-2219204, TP for TR 38.718-03-01\_3DL\_2UL CA\_n39A-n41A-n79, ZTE Corporation | 0.3.0 |
| 2023-03 | RAN4#106 | R4-2302552 |  |  |  | 1. R4-2301075, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n1-n3-n40, Ericsson  2. R4-2301077, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n1-n40-n77, Ericsson  3. R4-2301078, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n3-n40-n77, Ericsson  4. R4-2301079, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n28-n40-n77, Ericsson  5. R4-2302499, TP for TR 38.718-03-01: support of CA\_n1-n3-n8 2UL/3DL, CHTTL  6. R4-2303599, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n3-n7-n67 and DC\_n3-n7-n67, Ericsson, BT  7. R4-2303600, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm) to include CA\_n3-n67-n78 and DC\_n3-n67-n78, Ericsson, BT  8. R4-2303601, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n3A-n20A-n28A, Ericsson, BT  9. R4-2303603, TP for TR 38.718-03-01 to introduce CA\_n3A-n7A-n79A\_BCS0, Huawei, HiSilicon | 0.4.0 |
| 2023-04 | RAN4#106bis-e | R4-2304725 |  |  |  | 1. R4- 2304524, TP to TR 38.718-03-01 for CA\_n1-n28-n46 and DC\_n1-n28-n46, Huawei, HiSilicon, BT plc  2. R4-2304756, TP for TR 38.718-03-01: to include band combination CA\_n25A-n41A-n85A, Ericsson, T-Mobile US  3. R4-2305141, TP for TR38.718-03-01\_3DL\_2UL CA\_n28A-n39A-n40A, ZTE Corporation  4. R4-2305369, Updated TP for TR 38.718-03-01 to introduce CA\_n3B-n7A-n79A and CA\_n3(2A)-n7A-n79A, Huawei, HiSilicon  5. R4- 2306521, TP to TR 38.718-03-01 for CA\_n1-n46-n78 and DC\_n1-n46-n78, Huawei, HiSilicon, BT plc  6. R4-2306522, TP for TR 38.718-03-01: to include band combination CA\_n25A-n66A-n85A, Ericsson, T-Mobile US  7. R4-2306523, TP for TR 38.718-03-01: to include band combination CA\_n41A-n77A-n85A, Ericsson, T-Mobile US  8. R4-2306524, TP for TR 38.718-03-01: to include band combination CA\_n66A-n77A-n85A, Ericsson, T-Mobile US  9. R4-2306525, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n1-n7-n67 and DC\_n1-n7-n67, Ericsson, BT plc  10. R4-2306526, TP for TR [38.718-03-01](https://www.3gpp.org/DynaReport/38718-02-01.htm): CA\_n1-n67-n78 and DC\_n1-n67-n78, Ericsson, BT plc  11. R4-2306528, TP for TR38.718-03-01\_3DL\_2UL CA\_n3A-n8A-n79A, ZTE Corporation  12. R4-2306529, TP for TR 38.718-03-01: support of CA\_n3-n7-n8 2UL/3DL, CHTTL  13. R4-2304758, TP for TR 38.718-03-01: to include band combination CA\_n25A-n77A-n85A, Ericsson, T-Mobile US | 0.5.0 |
| 2023-05 | RAN4#107 | R4-2307977 |  |  |  | 1. R4-2308176, TP for TR38.718-03-01\_3DL\_2UL CA\_n8A-n39A-n41A, ZTE Corporation, RAN4#107. 2. R4-2308177, TP for TR38.718-03-01\_3DL\_2UL CA\_n8A-n39A-n79A, ZTE Corporation, RAN4#107. 3. R4-2309393, TP for 38.718-03-01 to include CA\_n7-n67-n78 and DC\_n7-n67-n78, Ericsson, BT plc, RAN4#107. 4. R4-2309515, TP for 38.718-03-01 to include CA\_n41A-n66A-n85A, Ericsson, T-Mobile USA, RAN4#107. 5. R4-2310351, TP to TR 38.718-03-01 Addition to CA\_n1-n28-n102 and DC\_n1-n28-n102, Nokia, BT, RAN4#107. 6. R4-2310352, TP to TR 38.718-03-01 Addition to CA\_n1-n78-n102 and DC\_n1-n78-n102, Nokia, BT, RAN4#107. 7. R4-2310353, TP to TR 38.718-03-01 Addition to CA\_n7-n78-n102 and DC\_n7-n78-n102, Nokia, BT, RAN4#107. 8. R4-2310354 TP to TR 38.718-03-01 Addition to CA\_n28-n78-n102 and DC\_n28-n78-n102, Nokia, BT, RAN4#107. 9. R4-2310356, TP to TR 38.718-03-01 Addition of CA\_n1-n3-n105, Nokia, AMX, RAN4#107. 10. R4-2310357, TP to TR 38.718-03-01 Addition of CA\_n1-n40-n105, Nokia, AMX, RAN4#107. 11. R4-2310358, TP to TR 38.718-03-01 Addition of CA\_n1\_n78\_n105, Nokia, AMX, RAN4#107. 12. R4-2310359, TP to TR 38.718-03-01 Addition of CA\_n3\_n40\_n105, Nokia, AMX, RAN4#107. 13. R4-2310360, TP to TR 38.718-03-01 Addition of CA\_n3\_n78\_n105, Nokia, AMX, RAN4#107. 14. R4-2310361, TP to TR 38.718-03-01 Addition of CA\_n40\_n78\_n105, Nokia, AMX, RAN4#107. 15. R4-2310371, TP for 38.718-03-01 to include CA\_n5A-n41A-n66A, Ericsson, Rogers, RAN4#107. 16. R4-2310414, TP for 38.718-03-01 to include CA\_n2A-n5A-n41A, Ericsson, Rogers, RAN4#107. | 0.6.0 |
| 2023-08 | RAN4#108 | R4-2312592 |  |  |  | 1. R4-2313036, TP to TR 38.718-03-01 Addition to CA\_n1-n78(2A)-n102 of ULCA n78(2A), Nokia, BT 2. R4-2313037, TP to TR 38.718-03-01 Addition to CA\_n7-n78(2A)-n102 of ULCA n78(2A), Nokia, BT 3. R4-2313038, TP to TR 38.718-03-01 Addition to CA\_n28-n78(2A)-n102 of ULCA n78(2A) , Nokia, BT 4. R4-2314779, TP for TR 38.718-03-01 to include CA\_n29-n66-n71, Samsung, DISH Network 5. R4-2314783, TP for TR38.718-03-01\_3DL\_2UL CA\_n8A-n41A-n79A, ZTE 6. R4-2314784, TP for TR38.718-03-01\_3DL\_2UL CA\_n28A-n39A-n79A, ZTE 7. R4-2314795, TP to TR 38.718-03-01 Addition to CA\_n46-n78(2A)-n102 of ULCA n78(2A), Nokia, BT 8. R4-2314796, TP to TR 38.718-03-01 Addition to CA\_n3-n40-n78 w ULCA, Nokia, Spark 9. R4-2314798, TP for 38.718-03-01 to include CA\_n2A-n71A-n77A, Ericsson, Rogers 10. R4-2314800, TP for 38.718-03-01 to include CA\_n25A-n71A-n85A, Ericsson, T-Mobile US 11. R4-2314801, TP for 38.718-03-01 to include CA\_n41A-n71A-n85A, Ericsson, T-Mobile USA 12. R4-2314802, TP for 38.718-03-01 to include CA\_n66A-n71A-n85A Ericsson, T-Mobile USA 13. R4-2312948, Updated TP for TR 38.718-03-01 to introduce CA\_n3A-n7A-n79C, CA\_n3B-n7A-n79C and CA\_n3(2A)-n7A-n79C, Huawei, HiSilicon, MTS | 0.7.0 |
| 2023-10 | RAN4#108bis | R4-2316678 |  |  |  | 1. R4-2315458, TP for TR 38.718-03-01 to include CA\_n26-n29-n70, Samsung, DISH Network, Murata, Fujitsu 2. R4-2315467, TP for TR 38.718-03-01 to include CA\_n5-n25-n29, Samsung, TELUS, Bell Mobility 3. R4-2316246, TP for TR 38.718-03-01: to include band combination CA\_n7A-n12A-n71A, Ericsson, Rogers 4. R4-2317682, TP for TR 38.718-03-01 to include CA\_n26-n29-n66, Samsung, DISH Network, Murata, Fujitsu 5. R4-2317684, TP for TR 38.718-03-01 to include CA\_n26-n48-n66, Samsung, DISH Network, Murata, Fujitsu 6. R4-2317685, TP for TR 38.718-03-01 to include CA\_n26-n48-n70, Samsung, DISH Network, Fujitsu 7. R4-2317686, TP for TR 38.718-03-01 to include CA\_n26-n66-n71, Samsung, DISH Network, Fujitsu 8. R4-2317687, TP for TR 38.718-03-01 to include CA\_n26-n66-n77, Samsung, DISH Network, Murata, Fujitsu 9. R4-2317688, TP for TR 38.718-03-01 to include CA\_n26-n70-n77, Samsung, DISH Network, Fujitsu 10. R4-2317691, TP for TR 38.718-03-01 to include CA\_n5-n29-n66, Samsung, TELUS, Bell Mobility 11. R4-2317692, TP to TR 37.718-03-01: Addition of CA\_n1-n7-n105, Nokia, Spark 12. R4-2317693, TP to TR 37.718-03-01: Addition of CA\_n3-n7-n105, Nokia, Spark 13. R4-2317694, TP to TR 37.718-03-01: Addition of CA\_n7-n78-n105, Nokia, Spark 14. R4-2317695, TP to TR 38.718-03-01 Addition to CA\_n7-n40-n105, Nokia, Spark 15. R4-2317704, TP for TR 38.718-03-01: to include band combination CA\_n12A-n71A-n77A, Ericsson, Rogers 16. R4-2317705, TP for TR 38.718-03-01: to include band combination CA\_n2A-n12A-n71A, Ericsson, Rogers 17. R4-2317706, TP for TR38.718-03-01\_3DL\_2UL CA\_n34A-n39A-n40A, ZTE 18. R4-2317710, TP for 38.718-03-01 to include CA\_n3-n7-n20 and DC\_n3-n7-n20, Ericsson, BT plc 19. R4-2317711, TP for 38.718-03-01 to include CA\_n3-n20-n78 and DC\_n3-n20-n78, Ericsson, BT plc 20. R4-2317712, TP for 38.718-03-01 to include CA\_n7-n20-n67 and DC\_n7-n20-n67, Ericsson, BT plc 21. R4-2317713, TP for 38.718-03-01 to include CA\_n7-n20-n78 and DC\_n7-n20-n78, Ericsson, BT plc 22. R4-2317714, TP for 38.718-03-01 to include CA\_n20-n67-n78 and DC\_n20-n67-n78, Ericsson, BT plc | 0.8.0 |
| 2023-11 | RAN4#109 | R4-2319600 |  |  |  | 1. R4-2319663, TP for 38.718-03-01 to include CA\_n5-n28-n79, Ericsson 2. R4-2319753, TP for TR 38.718-03-01 to include CA\_n26-n70-n71, Samsung, DISH Network, Fujitsu 3. R4-2320103, TP for TR38.718-03-01\_update MSD for 3DL\_2UL CA\_n8A-n39A-n79A, ZTE 4. R4-2321840, TP for 38.718-03-01 to include CA\_n1-n5-n79, Ericsson 5. R4-2321841, TP for 38.718-03-01 to include CA\_n3-n5-n28, Ericsson 6. R4-2321842, TP for 38.718-03-01 to include CA\_n3-n5-n79, Ericsson 7. R4-2321843, TP for 38.718-03-01 to include CA\_n5-n78-n79, Ericsson 8. R4-2321844, TP for 38.718-03-01 to include CA\_n5-n28-n78, Ericsson 9. R4-2321861, TP for TR38.718-03-01\_3DL\_xUL CA\_n34A-n39A-n41, ZTE 10. R4-2321862, TP for TR38.718-03-01\_3DL\_xUL CA\_n34A-n40A-n41, ZTE 11. R4-2321863, TP for TR38.718-03-01\_3DL\_xUL CA\_n34A-n41-n79A, ZTE 12. R4-2321875, TP for 38.718-03-01 to include CA\_n1-n5-n28, Ericsson 13. R4-2321851, TP to TR38.718-03-01 Addition of UE co-existence studies for triple beat, Nokia, Nokia Shanghai Bell | 0.9.0 |