3GPP TR 37.875 V0.7.0 (2022-03)

Technical Report

3rd Generation Partnership Project;

Technical Specification Group Radio Access Network;

Band combinations for con-current operation of NR/LTE Uu bands/band combinations and one NR/LTE V2X PC5 band (Release 17)

** 

The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP..  
The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented.  
This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification.  
Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices.

***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

***Copyright Notification***

No part may be reproduced except as authorized by written permission.  
The copyright and the foregoing restriction extend to reproduction in all media.

© 2021, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).

All rights reserved.

UMTS™ is a Trade Mark of ETSI registered for the benefit of its members

3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners  
LTE™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners

GSM® and the GSM logo are registered and owned by the GSM Association

Contents

[Foreword 5](#_Toc70594753)

[1 Scope 6](#_Toc70594754)

[2 References 6](#_Toc70594755)

[3 Definitions, symbols and abbreviations 6](#_Toc70594756)

[3.1 Definitions 6](#_Toc70594757)

[3.2 Symbols 6](#_Toc70594758)

[3.3 Abbreviations 7](#_Toc70594759)

[4 Background 7](#_Toc70594760)

[4.1 Justification 7](#_Toc70594761)

[4.2 Objective 7](#_Toc70594762)

[5 Additional UE RF: General part 8](#_Toc70594763)

[5.1 UE RF aspects 8](#_Toc70594764)

[5.1.1 Basic UE RF architecture and assumed performance with ITS band 47/n47 8](#_Toc70594765)

[5.2 RRM aspects 9](#_Toc70594766)

[6 Con-current operation with one Uu band and one PC5 band 9](#_Toc70594767)

[6.1 Con-current operation between one LTE Uu band and one NR PC5 band 9](#_Toc70594768)

[6.1.1 V2X\_39A-n47A 9](#_Toc70594769)

[6.1.1.1 Operating bands for V2X\_39A-n47A 9](#_Toc70594770)

[6.1.1.2 Channel bandwidths per operating band for V2X\_39A-n47A 9](#_Toc70594771)

[6.1.1.3 UE co-existence studies 9](#_Toc70594772)

[6.1.2 V2X\_40A-n47A 10](#_Toc70594773)

[6.1.2.1 Operating bands for V2X\_40A-n47A 10](#_Toc70594774)

[6.1.2.2 Channel bandwidths per operating band for V2X\_40A-n47A 10](#_Toc70594775)

[6.1.2.3 UE co-existence studies 10](#_Toc70594776)

[6.1.3 V2X\_41A-n47A 10](#_Toc70594777)

[6.1.3.1 Operating bands for V2X\_41A-n47A 10](#_Toc70594778)

[6.1.3.2 Channel bandwidths per operating band for V2X\_41A-n47A 11](#_Toc70594779)

[6.1.3.3 UE co-existence studies 11](#_Toc70594780)

[6.2 Con-current operation between one NR Uu band and one NR PC5 band 11](#_Toc70594781)

[6.2.1 V2X\_n39A-n47A 11](#_Toc70594782)

[6.2.1.1 Operating bands for V2X\_n39A-n47A 11](#_Toc70594783)

[6.2.1.2 Channel bandwidths per operating band for V2X\_n39A-n47A 12](#_Toc70594784)

[6.2.1.3 UE co-existence studies 12](#_Toc70594785)

[6.2.2 V2X\_n40A-n47A 14](#_Toc70594786)

[6.2.2.1 Operating bands for V2X\_n40A-n47A 14](#_Toc70594787)

[6.2.2.2 Channel bandwidths per operating band for V2X\_n40A-n47A 14](#_Toc70594788)

[6.2.2.3 UE Coexistence studies 15](#_Toc70594789)

[6.2.3 V2X\_n41A-n47A 18](#_Toc70594790)

[6.2.3.1 Operating bands for V2X\_n41A-n47A 18](#_Toc70594791)

[6.2.3.2 Channel bandwidths per operating band for V2X\_n41A-n47A 18](#_Toc70594792)

[6.2.3.3 Coexistence studies 19](#_Toc70594793)

[6.2.4 V2X\_n79A-n47A 22](#_Toc70594794)

[6.2.4.1 Operating bands for V2X\_n79A-n47A 22](#_Toc70594795)

[6.2.4.2 Channel bandwidths per operating band for V2X\_n79A-n47A 22](#_Toc70594796)

[6.2.4.3 Coexistence studies 23](#_Toc70594797)

[6.3 Con-current operation between one NR Uu band and one LTE PC5 band 25](#_Toc70594798)

[6.3.1 V2X\_n39A-47A 25](#_Toc70594799)

[6.3.1.1 Operating bands for V2X\_n39A-47A 25](#_Toc70594800)

[6.3.1.2 Channel bandwidths per operating band for V2X\_n39A-47A 25](#_Toc70594801)

[6.3.1.3 UE co-existence studies 26](#_Toc70594802)

[6.3.2 V2X\_n40A-47A 26](#_Toc70594803)

[6.3.2.1 Operating bands for V2X\_n40A-47A 26](#_Toc70594804)

[6.3.2.2 Channel bandwidths per operating band for V2X\_n40A-47A 26](#_Toc70594805)

[6.3.2.3 UE co-existence studies 27](#_Toc70594806)

[6.3.3 V2X\_n41A-47A 27](#_Toc70594807)

[6.3.3.1 Operating bands for V2X\_n41A-47A 27](#_Toc70594808)

[6.3.3.2 Channel bandwidths per operating band for V2X\_n41A-47A 28](#_Toc70594809)

[6.3.3.3 UE co-existence studies 29](#_Toc70594810)

[6.3.4 V2X\_n79A-47A 29](#_Toc70594811)

[6.3.4.1 Operating bands for V2X\_n79A-47A 29](#_Toc70594812)

[6.3.4.2 Channel bandwidths per operating band for V2X\_n79A-47A 30](#_Toc70594813)

[6.3.4.3 UE co-existence studies 30](#_Toc70594814)

[7 Other specification impacts (if applicable) 30](#_Toc70594815)

# Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

The present document is the Technical Report on TR on band combinations for con-current operation of NR/LTE Uu bands/band combinations and one NR/LTE V2X band.

The purpose of the present document is to study the extension of the band combinations for V2X service to grow the NR V2X ecosystem. Operators propose new band combinations for con-current operation of NR/LTE Uu bands/band combinations and one NR/LTE V2X band. Whether to specify con-current operation of LTE/NR CA/DC band combinations and V2X band depends on requests in Rel-17. Specifically, the self-desensitization problem of con-current operation band combinations will be analysed including harmonics, IMD problem, etc.. Also the candidate solutions will be studied to solve the self-desensitization problem.

Table 1-1: Release 17 NR V2X band combinations

|  |  |
| --- | --- |
| **V2X Band combination** | **REL independent from** |
| V2X\_n39-n47 | Rel-16 |
| V2X\_n40-n47 | Rel-16 |
| V2X\_n41-n47 | Rel-16 |
| V2X\_n78-n47 | Rel-16 |
| V2X\_n79-n47 | Rel-16 |
| V2X\_n39\_47 | Rel-16 |
| V2X\_n40\_47 | Rel-16 |
| V2X\_n41\_47 | Rel-16 |
| V2X\_n78\_47 | Rel-16 |
| V2X\_n79\_47 | Rel-16 |
| V2X\_3\_n47 | Rel-16 |
| V2X\_39\_n47 | Rel-16 |
| V2X\_40\_n47 | Rel-16 |
| V2X\_41\_n47 | Rel-16 |

Note: All band combinations in table 1-1 that are release independent from Rel-16 are optional

# 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

[2] RP-20xxxxx: " Revised basket WID: Band combinations for concurrent operation of NR/LTE Uu bands/band combinations and one NR/LTE V2X PC5 band".

[3] 3GPP TR 38.886 V16.0.0: " V2X Services based on NR; User Equipment (UE) radio transmission and reception”.

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

## 3.2 Symbols

(Void)

## 3.3 Abbreviations

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

# 4 Background

## 4.1 Justification

3GPP has completed the Release 16 work item on NR V2X including RAN4 minimum requirements and frequency bands for V2X operation. The current specification considers an initial set of frequency bands for PC5 interface and requirement frame work for con-current operation between Uu bands and V2X bands as part of Release 16 work.

However, in order to further enhance the V2X ecosystem, it is necessary to set up a basket WI to introduce more band combinations on con-current operation of Uu bands and V2X bands in Release 17.

## 4.2 Objective

The objective of this work item is to specify band specific RF requirements for the following scenarios with maximum two simultaneous transmission bands within FR1:

- Con-current operation between NR Uu band and NR PC5 band.

- Con-current operation between LTE Uu band and NR PC5 band.

- Con-current operation between NR Uu band and LTE PC5 band.

- Whether to specify con-current operation of LTE/NR CA/DC band combinations + PC5 V2X band depending on requests in Rel-17.

- If there is such request the denotation on the combination definition need to be discussed at first.

- Analyse con-current operation band combinations that have self-desensitization due to following reasons:

- TX Harmonic and/or inter modulation overlap of receive band

- TX signal overlap of receiver harmonic frequency

- TX frequency being in close proximity of one of the receive bands

- Any other identified reasons

- For the combination where self-desensitization exists, specify at least needed

- ∆TIB and ∆RIB

- Reference sensitivity excerptions

- UL/SL RB restrictions for REFSENS test

- Add conformance testing in RAN5 specifications (to follow at a later stage)

of all REL-17 V2X con-current operation band combinations that fall into the category defined by the WI title.

An overview of these V2X con-current operation band combinations is provided in the attached Excel.

# 5 Additional UE RF: General part

## 5.1 UE RF aspects

### 5.1.1 Basic UE RF architecture and assumed performance with ITS band 47/n47

Based on the investigation, the band 47/n47 filter performance are shown in table 5.1.1-1.

Table 5.1.1-1 Filter performance for band n47/47

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Filter | IL [dB] | Min Attenuation [dB] @ | | |
| Worst Case | 410-2690 MHz | 3300-4200 MHz | 4400-5000 MHz |
| n47/47 (5855-5925 MHz) | [2] | > [35] | > [32] | > [30] |

It’s assumed that the antenna isolation between band n47 and Uu licensed bands which is below 5GHz is about [15]dB. An example RF architecture for NR V2X band combinations with ITS band 47/n47 is shown in figure 5.1.1-1. It’s assumed that separate antennas is used for NR V2X band combination with ITS band 47/n47. Since separate antennas are assumed, there is no need to specify ΔTIB,c and ΔRIB,c for band 47/n47.

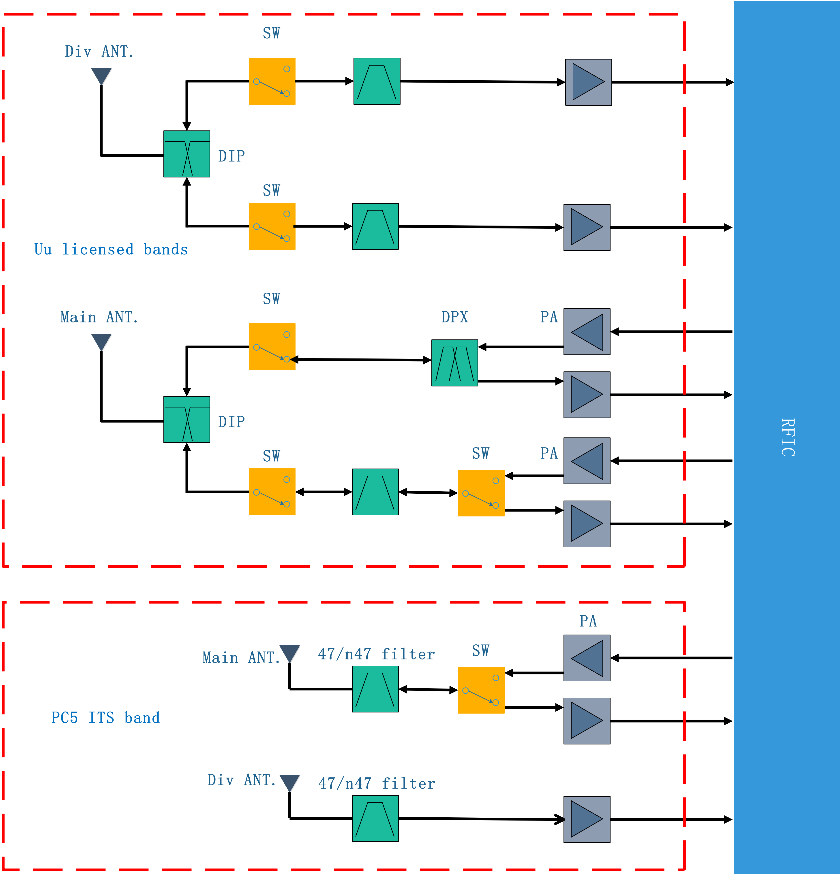


Figure 5.1.1-1 NR V2X band combinations RF architecture with separate antennas

## 5.2 RRM aspects

*Editor Note: It will be added in the future [FFS]*

# Con-current operation with one Uu band and one PC5 band

## 6.1 Con-current operation between one LTE Uu band and one NR PC5 band

### 6.1.1 V2X\_39A\_n47A

#### 6.1.1.1 Operating bands for V2X\_39A\_n47A

The operating bands for V2X\_39A\_n47A are specified in table 6.1.1.1-1.

**Table 6.1.1.1-1: Inter-band con-current V2X operating bands for V2X\_39A\_n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_39A\_n47A | 39 | Uu | 1880 MHz | – | 1920 MHz | 1880 MHz | – | 1920 MHz | TDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.1.1.2 Channel bandwidths per operating band for V2X\_39A\_n47A

The channel bandwidths per operating band for V2X\_39A\_n47A are specified in table 6.1.1.2-1.

**Table 6.1.1.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_39A\_n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_39A\_n47A | 39 | 15 | Yes | Yes | Yes | Yes |  |  |  | 60 | 0 |
| n47 | 15 |  | Yes |  | Yes |  | Yes | Yes |
| 30 |  | Yes |  | Yes |  | Yes | Yes |
| 60 |  | Yes |  | Yes |  | Yes | Yes |

#### 6.1.1.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n39A-n47A in clause 6.2.1.3 are applicable to V2X\_39A\_n47A since band 39 and band n39 have the same frequency range.

### 6.1.2 V2X\_40A\_n47A

#### 6.1.2.1 Operating bands for V2X\_40A\_n47A

The operating bands for V2X\_40A\_n47A are specified in table 6.1.2.1-1.

**Table 6.1.2.1-1: Inter-band con-current V2X operating bands for V2X\_40A\_n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR OperatingBand** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_40A\_n47A | 40 | Uu | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.1.2.2 Channel bandwidths per operating band for V2X\_40A\_n47A

The channel bandwidths per operating band for V2X\_40A\_n47A are specified in table 6.1.2.2-1.

**Table 6.1.2.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_40A\_n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_40A\_n47A | 40 | 15 | Yes | Yes | Yes | Yes |  |  |  | 60 | 0 |
| n47 | 15 |  | Yes |  | Yes |  | Yes | Yes |
| 30 |  | Yes |  | Yes |  | Yes | Yes |
| 60 |  | Yes |  | Yes |  | Yes | Yes |

#### 6.1.2.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n40A-n47A in clause 6.2.2.3 are applicable to V2X\_40A\_n47A since band 40 and band n40 have the same frequency range.

### 6.1.3 V2X\_41A\_n47A

#### 6.1.3.1 Operating bands for V2X\_41A\_n47A

The operating bands for V2X\_41A\_n47A are specified in table 6.1.3.1-1.

**Table 6.1.3.1-1: Inter-band con-current V2X operating bands for V2X\_41A\_n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_41A\_n47A | 41 | Uu | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.1.3.2 Channel bandwidths per operating band for V2X\_41A\_n47A

The channel bandwidths per operating band for V2X\_41A\_n47A are specified in table 6.1.3.2-1.

**Table 6.1.3.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_41A\_n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_41A\_n47A | 41 | 15 | Yes | Yes | Yes | Yes |  |  |  | 60 | 0 |
| n47 | 15 |  | Yes |  | Yes |  | Yes | Yes |
| 30 |  | Yes |  | Yes |  | Yes | Yes |
| 60 |  | Yes |  | Yes |  | Yes | Yes |

#### 6.1.3.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n41A-n47A in clause 6.2.3.3 are applicable to V2X\_41A\_n47A since band 41 and band n41 have the same frequency range.

### 6.1.4 V2X\_3A\_n47A

#### 6.1.4.1 Operating bands for V2X\_3A\_n47A

The operating bands for V2X\_3A\_n47A are specified in table 6.1.4.1-1.

**Table 6.1.4.1-1: Inter-band con-current V2X operating bands for V2X\_3A\_n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_3A\_n47A | 3 | Uu | 1710 MHz | – | 1785 MHz | 1805 MHz | – | 1880 MHz | FDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.1.4.2 Channel bandwidths per operating band for V2X\_3A\_n47A

The channel bandwidths per operating band for V2X\_3A\_n47A are specified in table 6.1.4.2-1.

**Table 6.1.4.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_3A\_n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_3A\_n47A | 3 | 15 | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  | 60 | 0 |
| n47 | 15 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |
| 30 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |
| 60 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |

#### 6.1.4.3 UE co-existence studies

The harmonics analysis for V2X\_3A\_n47A is specified in table 6.1.4.3-1. Up to the 3rd harmonics of band 3 are provided since the frequency range of the 4th harmonics is higher than 5.9GHz. The harmonics of band n47 are not listed as the harmonics distributed in the frequency range much higher than 5.9GHz have no impact on GNSS and ISM bands. Based on the harmonics analysis, it is observed that the 3rd harmonics of band 3 have no impact on band n47.

**Table 6.1.4.3-1: Harmonics analysis for V2X\_3A\_n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Band 3 | | Band n47 | |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 1710 | 1785 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | No effect | |
| 2nd harmonics frequency limits (MHz) | 3420 | 3570 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | No effect | |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 |

The IMD analysis for V2X\_3A\_n47A is specified in table 6.1.4.3-2. Up to the 5th order IMDs of band 3 and band n47 are provided. Based on the IMD analysis, it is observed that no IMD products fall into the associated bands. So there is no IMD issue causeds by the band combination.

**Table 6.1.4.3-2: IMD analysis for V2X\_3A\_n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **Band 3** | | **Band n47** | |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1710 | 1785 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3420 | 3570 | 11710 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5130 | 5355 | 17565 | 17775 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4070 | 4215 | 7565 | 7710 |
| Two-tone 3rd order IMD products | |2\*fx\_low – fy\_high| | |2\*fx\_high – fy\_low| | |2\*fy\_low – fx\_high| | |2\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 2505 | 2285 | 9925 | 10140 |
| 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) | 9275 | 9425 | 13420 | 13635 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 795 | 500 | 15780 | 16065 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 10985 | 11280 | 19275 | 19560 |
| 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) | 8430 | 8140 | 15130 | 15420 |
| 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) | 21990 | 21635 | 1285 | 915 |
| 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) | 25130 | 25485 | 12695 | 13065 |
| 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) | 14355 | 13995 | 6355 | 6720 |
| 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) | 20985 | 21345 | 16840 | 17205 |

The harmonics and intermodulation products should be evaluated when V2X inter-band con-current operating UE coexists with other systems such as GNSS and ISM. The harmonics and IMD analysis of V2X\_3A\_n47A for GNSS and ISM bands is shown in table 6.1.4.3-3. Based on the analysis for GNSS and ISM bands, band n47 and the 3rd harmonics of band 3 have an impact on the ISM band (5GHZ).

**Table 6.1.4.3-3: Harmonic and IMDs analysis of V2X\_3A\_n47A UE for GNSS and ISM bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | Band n47 and 3rd harmonics of band 3 |
| 5150 | - | 5350 | Yes | Europe | 3rd harmonics of band 3 |
| 5470 | - | 5725 | Yes | 3rd harmonics of band 3 |
| 5150 | - | 5825 | Yes | Asia | 3rd harmonics of band 3 |

### 6.1.5 V2X\_8A\_n47A

#### 6.1.5.1 Operating bands for V2X\_8A\_n47A

The operating bands for V2X\_8A\_n47A are specified in table 6.1.5.1-1.

**Table 6.1.5.1-1: Inter-band con-current V2X operating bands for V2X\_8A\_n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_8A\_n47A | 8 | Uu | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.1.5.2 Channel bandwidths per operating band for V2X\_8A\_n47A

The channel bandwidths per operating band for V2X\_8A\_n47A are specified in table 6.1.5.2-1.

**Table 6.1.5.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_8A\_n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_8A\_n47A | 8 | 15 | Yes | Yes | Yes | Yes |  |  |  |  |  |  | 50 | 0 |
| n47 | 15 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |
| 30 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |
| 60 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |

#### 6.1.5.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n8A-n47A in clause 6.2.6.3 are applicable to V2X\_8A\_n47A since band 8 and band n8 have the same frequency range.

### 6.1.6 V2X\_1A\_n47A

#### 6.1.6.1 Operating bands for V2X\_1A\_n47A

The operating bands for V2X\_1A\_n47A are specified in table 6.1.6.1-1.

**Table 6.1.6.1-1: Inter-band con-current V2X operating bands for V2X\_1A\_n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_1A\_n47A | 1 | Uu | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.1.6.2 Channel bandwidths per operating band for V2X\_1A\_n47A

The channel bandwidths per operating band for V2X\_1A\_n47A are specified in table 6.1.6.2-1.

**Table 6.1.6.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_1A\_n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **1.4 MHz** | **3 MHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_1A\_n47A | 1 | 15 |  |  | Yes | Yes | Yes | Yes |  |  |  |  | 60 | 0 |
| n47 | 15 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |
| 30 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |
| 60 |  |  |  | Yes |  | Yes |  | Yes | Yes |  |

#### 6.1.6.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n1A-n47A in clause 6.2.7.3 are applicable to V2X\_1A\_n47A since band 1 and band n1 have the same frequency range.

6.1.6.4 MSD

MSD test configurations are specified below for V2X\_1A-n47A. The MSD values given in table 6.1.6.4-1.

**Table 6.1.6.4-1: Reference sensitivity exceptions (MSD) due to cross band isolation for V2X**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **SL band** | **SCS of UL/DL band (kHz)** | **LCRB of UL band** | **UL band BW(MHz)** | **LCRB of SL band** | **SL band BW (MHz)** | **MSD value of SL band (dB)** |
| 1 | n47 | 15 | 50 | 10 | 50 | 10 | 19.2 |
| 1 | n47 | 15 | 50 | 10 | 105 | 20 | 15.9 |
| 1 | n47 | 15 | 50 | 10 | 160 | 30 | 14.2 |
| 1 | n47 | 15 | 50 | 10 | 216 | 40 | 13.0 |

## 6.2 Con-current operation between one NR Uu band and one NR PC5 band

### 6.2.1 V2X\_n39A-n47A

#### 6.2.1.1 Operating bands for V2X\_n39A-n47A

The operating bands for V2X\_n39A-n47A are specified in table 6.2.1.1-1.

**Table 6.2.1.1-1: Inter-band con-current V2X operating bands for V2X\_n39A-n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **NR OperatingBand** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit1** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n39A-n47A | n39 | Uu | 1880 MHz | – | 1920 MHz | 1880 MHz | – | 1920 MHz | TDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.2.1.2 Channel bandwidths per operating band for V2X\_n39A-n47A

The channel bandwidths per operating band for V2X\_n39A-n47A are specified in table 6.2.1.2-1.

**Table 6.2.1.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n39A-n47A**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **Maximum aggregated bandwidth**  **[MHz]** | **Bandwidth combination set** |
| V2X\_n39A-n47A | n39 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | 80 | 0 |
| n47 |  | Yes |  | Yes |  | Yes | Yes |

#### 6.2.1.3 UE co-existence studies

The harmonics analysis for V2X\_n39A-n47A is specified in table 6.2.1.3-1. Up to the 3rd harmonics of band n39 are provided since the frequency range of the 4th harmonics is higher than 5.9GHz. The harmonics of band n47 are not listed as the harmonics distributed in the frequency range much higher than 5.9GHz have no impact on GNSS and ISM bands. Based on the harmonics analysis, it is observed that the 3rd harmonics of band n39 have no impact on band n47.

**Table 6.2.1.3-1: Harmonics analysis for V2X\_n39A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Band n39 | | Band n47 | |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 1880 | 1920 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | No effect | |
| 2nd harmonics frequency limits (MHz) | 3760 | 3840 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | No effect | |
| 3rd harmonics frequency limits (MHz) | 5640 | 5760 |

The IMD analysis for V2X\_n39A-n47A is specified in table 6.2.1.3-2. Up to the 5th order IMDs of band n39 and band n47 are provided. Based on the IMD analysis, it is observed that no IMD products fall into the associated bands. So there is no IMD issue caused by such three band combinations.

**Table 6.2.1.3-2: IMD analysis for V2X\_n39A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **Band n39** | | **Band n47** | |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1880 | 1920 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3760 | 3840 | 11710 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5640 | 5760 | 17565 | 17775 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3935 | 4045 | 7735 | 7845 |
| 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) | 2165 | 2015 | 9790 | 9970 |
| 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) | 9615 | 9765 | 13590 | 13770 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 285 | 95 | 15645 | 15895 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 11495 | 11685 | 19445 | 19695 |
| 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) | 8090 | 7870 | 15470 | 15690 |
| 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) | 21820 | 21500 | 1825 | 1595 |
| 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) | 25300 | 25620 | 13375 | 13605 |
| 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) | 14015 | 13725 | 5950 | 6210 |
| 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) | 21325 | 21615 | 17350 | 17610 |

The harmonics and intermodulation products should be evaluated when V2X inter-band con-current operating UE coexists with other systems such as GNSS and ISM. The harmonics and IMD analysis of V2X\_n39A-n47A for GNSS and ISM bands is shown in table 6.2.1.3-3. Based on the analysis for GNSS and ISM bands, band n47 and the 3rd harmonics of band n39 have an impact on the ISM band (5GHZ).

**Table 6.2.1.3-3: Harmonic and IMDs analysis of V2X\_n39A-n47A UE for GNSS and ISM bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | Band n47 and 3rd harmonics of band n39 |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | Yes | 3rd harmonics of band n39 |
| 5150 | - | 5825 | Yes | Asia | 3rd harmonics of band n39 |

### 6.2.2 V2X\_n40A-n47A

#### 6.2.2.1 Operating bands for V2X\_n40A-n47A

The operating bands for V2X\_n40A-n47A are specified in table 6.2.2.1-1.

**Table 6.2.2.1-1: Inter-band con-current V2X operating bands for V2X\_n40A-n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **NR OperatingBand** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit1** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n40A-n47A | n40 | Uu | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.2.2.2 Channel bandwidths per operating band for V2X\_n40A-n47A

The channel bandwidths per operating band for V2X\_n40A-n47A are specified in table 6.2.2.2-1.

**Table 6.2.2.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n40A-n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **80 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n40A-n47A | n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  | 120 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| n47 | 15 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |
| 30 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |
| 60 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |

#### 6.2.2.3 UE Coexistence studies

The harmonics analysis for V2X\_n40A-n47A is specified in table 6.2.2.3-1. Up to the 3rd harmonics of band n40 are provided since the frequency range of the 4th harmonics is higher than 5.9GHz. The harmonics of band n47 are not listed as the harmonics distributed in the frequency range much higher than 5.9GHz have no impact on GNSS and ISM bands. Based on the harmonics analysis, it is observed that the 3rd harmonics of band n40 have no impact on band n47.

**Table 6.2.2.3-1: Harmonics analysis for V2X\_n40A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Band n40 | | Band n47 | |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 2300 | 2400 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | No effect | |
| 2nd harmonics frequency limits (MHz) | 4600 | 4800 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | No effect | |
| 3rd harmonics frequency limits (MHz) | 6900 | 7200 |

The IMD analysis for V2X\_n40A-n47A is specified in table 6.2.2.3-2. Up to the 5th order IMDs of band n40 and band n47 are provided. Based on the IMD analysis, it is observed that no IMD products fall into the associated bands. So there is no IMD issue caused by the band combinations of V2X\_n40A-n47A.

**Table 6.2.2.3-2: IMD analysis for V2X\_n40A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **Band n40** | | **Band n47** | |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2300 | 2400 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 4600 | 4800 | 11710 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 6900 | 7200 | 17565 | 17775 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3455 | 3625 | 8155 | 8325 |
| 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) | 1325 | 1055 | 9310 | 9550 |
| 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) | 10455 | 10725 | 14010 | 14250 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 975 | 1345 | 15165 | 15475 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 12755 | 13125 | 19865 | 20175 |
| 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) | 7250 | 6910 | 16310 | 16650 |
| 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) | 21400 | 21020 | 3745 | 3275 |
| 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) | 25720 | 26100 | 15055 | 15525 |
| 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) | 13175 | 12765 | 4810 | 4950 |
| 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) | 22165 | 22575 | 18610 | 19050 |

The harmonics and intermodulation products should be evaluated when V2X inter-band con-current operating UE coexists with other systems such as GNSS and ISM. The harmonics and IMD analysis of V2X\_n40A-n47A for GNSS and ISM bands is shown in table 6.2.2.3-3. Based on the analysis for GNSS and ISM bands, band n47 have an impact on the ISM band (5GHz).

**Table 6.2.2.3-3: Harmonic and IMDs analysis of V2X\_n40A-n47A UE for GNSS and ISM bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | Band n47 |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | No | Asia |  |

### 6.2.3 V2X\_n41A-n47A

#### 6.2.3.1 Operating bands for V2X\_n41A-n47A

The operating bands for V2X\_n41A-n47A are specified in table 6.2.3.1-1.

**Table 6.2.3.1-1: Inter-band con-current V2X operating bands for V2X\_n41A-n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n41A-n47A | n41 | Uu | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.2.3.2 Channel bandwidths per operating band for V2X\_n41A-n47A

The channel bandwidths per operating band for V2X\_n41A-n47A are specified in table 6.2.3.2-1.

**Table 6.2.3.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n41A-n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n41A-n47A | n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  | 140 | 0 |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| n47 | 15 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |

#### 6.2.3.3 Coexistence studies

The harmonics analysis for V2X\_n41A-n47A is specified in table 6.2.3.3-1. Up to the 3rd harmonics of band n41 are provided since the frequency range of the 4th harmonics is higher than 5.9GHz. The harmonics of band n47 are not listed as the harmonics distributed in the frequency range much higher than 5.9GHz have no impact on GNSS and ISM bands. Based on the harmonics analysis, it is observed that the harmonics of band n41 have no impact on band n47.

**Table 6.2.3.3-1: Harmonics analysis for V2X\_n41A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Band n41 | | Band n47 | |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 2496 | 2690 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | No effect | |
| 2nd harmonics frequency limits (MHz) | 4992 | 5380 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | No effect | |
| 3rd harmonics frequency limits (MHz) | 7488 | 8070 |

The IMD analysis for V2X\_n41A-n47A is specified in table 6.2.3.3-2. Up to the 5th order IMDs of band n41 and band n47 are provided. Based on the IMD analysis, it is observed that no IMD products fall into the associated bands. So there is no IMD issue caused by the band combinations of V2X\_n41A-n47A.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Band** | **Band n41** | | **Band n47** | |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 2496 | 2690 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 4992 | 5380 | 11710 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 7488 | 8070 | 17565 | 17775 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3165 | 3429 | 8351 | 8615 |
| 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) | 933 | 475 | 9020 | 9354 |
| 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) | 10847 | 11305 | 14206 | 14540 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 1563 | 2215 | 14875 | 15279 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 13343 | 13995 | 20061 | 20465 |
| 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) | 6858 | 6330 | 16702 | 17230 |
| 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) | 21204 | 20730 | 4905 | 4059 |
| 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) | 25916 | 26390 | 15839 | 16685 |
| 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) | 12783 | 12185 | 3640 | 4362 |
| 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) | 22557 | 23155 | 19780 | 19920 |

**Table 6.2.3.3-2: IMD analysis for V2X\_n41A-n4**

The harmonics and intermodulation products should be evaluated when V2X inter-band con-current operating UE coexists with other systems such as GNSS and ISM. The harmonics and IMD analysis of V2X\_n41A-n47A for GNSS and ISM bands is shown in table 6.2.3.3-3. Based on the analysis for GNSS and ISM bands, band n47 have an impact on the ISM band (5GHz).

**Table 6.2.3.3-3: Harmonic and IMDs analysis of V2X\_n41A-n47A UE for GNSS and ISM bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  | 4th order MSD |
| Galileo | 1559 | - | 1591 | No |  | 4th order MSD |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  | 4th order MSD |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | Band n47 |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | No | Asia | 2nd harmonics |

### 6.2.4 V2X\_n79A-n47A

#### 6.2.4.1 Operating bands for V2X\_n79A-n47A

The operating bands for V2X\_n79A-n47A are specified in table 6.2.4.1-1.

**Table 6.2.4.1-1: Inter-band con-current V2X operating bands for V2X\_n79A-n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n79A-n47A | n79 | Uu | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.2.4.2 Channel bandwidths per operating band for V2X\_n79A-n47A

The channel bandwidths per operating band for V2X\_n79A-n47A are specified in table 6.2.4.2-1.

**Table 6.2.4.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n79A-n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n79A-n47A | n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  | 140 | 0 |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| n47 | 15 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |
| 30 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |

#### 6.2.4.3 Coexistence studies

The harmonics analysis for V2X\_n79A-n47A is specified in table 6.2.4.3-1. Only the 2nd harmonics of band n79 are provided since the frequency range of the 3rd harmonics is much higher than 5.9GHz. The harmonics of band n47 are not listed as the harmonics distributed in the frequency range much higher than 5.9GHz have no impact on GNSS and ISM bands. Based on the harmonics analysis, it is observed that the harmonics of band n79 have no impact on band n47.

**Table 6.2.4.3-1: Harmonics analysis for V2X\_n79A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Band n79 | | Band n47 | |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 4400 | 5000 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | No effect | |
| 2nd harmonics frequency limits (MHz) | 8800 | 10000 |

The IMD analysis for V2X\_n79A-n47A is specified in table 6.2.3.3-2. Up to the 5th order IMDs of band n79 and band n47 are provided. Based on the IMD analysis, it is observed that no IMD products fall into the associated bands. So there is no IMD issue caused by the band combinations of V2X\_n79A-n47A.

| **Operating Band** | **Band n79** | | **Band n47** | |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 4400 | 5000 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 8800 | 10000 | 11710 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 13200 | 15000 | 17565 | 17775 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 855 | 1525 | 8351 | 8615 |
| 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) | 2875 | 4145 | 6710 | 7450 |
| 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) | 14655 | 15925 | 16110 | 16850 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 7275 | 9145 | 12565 | 13375 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 19055 | 20925 | 22175 | 22775 |
| 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) | 3050 | 1710 | 20510 | 21850 |
| 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) | 19300 | 18420 | 14145 | 11675 |
| 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) | 27820 | 28700 | 23455 | 25925 |
| 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) | 8975 | 7565 | 3290 | 1350 |
| 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) | 26365 | 27775 | 24910 | 26850 |

**Table 6.2.4.3-2: IMD analysis for V2X\_n79A-n47A**

The harmonics and intermodulation products should be evaluated when V2X inter-band con-current operating UE coexists with other systems such as GNSS and ISM. The harmonics and IMD analysis of V2X\_n79A-n47A for GNSS and ISM bands is shown in table 6.2.4.3-3. Based on the analysis for GNSS and ISM bands, band n47 have an impact on the ISM band (5GHz).

**Table 6.2.4.3-3: Harmonic and IMDs analysis of V2X\_n79A-n47A UE for GNSS and ISM bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | Band n47 |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | No |  |
| 5150 | - | 5825 | No | Asia |  |

#### 6.2.4.4 MSD

The REFSENS exception due to cross band isolation can be observed for V2X\_n79A-n47A. One MSD test configuration is specified as below for each band combination. The MSD values given in table 6.2.4.4-1and 6.2.4.4-2 shall apply for all n79 and n47 BWs and SCSs combinations given in table 6.2.4.2-1.

Table 6.2.4.4-1: Reference sensitivity exceptions (MSD) due to cross band isolation for V2X band

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | SL reception band | SCS of UL/DL band (kHz) | LCRB of UL band | UL band BW(MHz) | LCRB of SL band | SL band BW (MHz) | MSD value of SL band (dB) |
| n79 | n47 | 15 | 216 | 40 | 50 | 10 | 3.3 |

**Table 6.2.4.4-2: Reference sensitivity exceptions (MSD) due to cross band isolation for Uu band**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SL transmission band** | **DL band** | **SCS of UL/DL band (kHz)** | **LCRB of SL transmission band** | **SL transmission BW(MHz)** | **LCRB of DL band** | **DL band BW (MHz)** | **MSD value of DL band (dB)** |
| n47 | n79 | 15 | 50 | 10 | 216 | 40 | 3.3 |

### 6.2.5 V2X\_n78A-n47A

#### 6.2.5.1 Operating bands for V2X\_n78A-n47A

The operating bands for V2X\_n78A-n47A are specified in table 6.2.5.1-1.

**Table 6.2.5.1-1: Inter-band con-current V2X operating bands for V2X\_n78A-n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n78A-n47A | n78 | Uu | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.2.5.2 Channel bandwidths per operating band for V2X\_n78A-n47A

The channel bandwidths per operating band for V2X\_n78A-n47A are specified in table 6.2.5.2-1.

**Table 6.2.5.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n78A-n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n78A-n47A | n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 140 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| n47 | 15 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |  |
| 30 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |  |
| 60 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |  |

#### 6.2.5.3 Coexistence studies

The harmonics analysis for V2X\_n78A-n47A is specified in table 6.2.5.3-1. Only the 2nd harmonics of band n78 are provided since the frequency range of the 3rd harmonics is much higher than 5.9GHz. The harmonics of band n47 are not listed as the harmonics distributed in the frequency range much higher than 5.9GHz have no impact on GNSS and ISM bands. Based on the harmonics analysis, it is observed that the harmonics of band n78 have no impact on band n47.

**Table 6.2.5.3-1: Harmonics analysis for V2X\_n78A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Band n78 | | Band n47 | |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 3300 | 3800 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | No effect | |
| 2nd harmonics frequency limits (MHz) | 6600 | 7600 |

The IMD analysis for V2X\_n78A-n47A is specified in table 6.2.5.3-2. Up to the 5th order IMDs of band n78 and band n47 are provided. Based on the IMD analysis, it is observed that no IMD products fall into the associated bands. So there is no IMD issue caused by the band combinations of V2X\_n78A-n47A.

| **Operating Band** | **Band n78** | | **Band n47** | |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 3300 | 3800 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 6600 | 7600 | 11710 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 9900 | 11400 | 17565 | 17775 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 2055 | 2625 | 9155 | 9725 |
| 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) | 675 | 1745 | 7910 | 8550 |
| 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) | 12455 | 13525 | 15010 | 15650 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 3975 | 5545 | 13765 | 14475 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 15755 | 17325 | 20865 | 21575 |
| 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) | 5250 | 4110 | 18310 | 19450 |
| 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) | 20400 | 19620 | 9345 | 7275 |
| 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) | 26720 | 27500 | 19055 | 21125 |
| 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) | 11175 | 9965 | 310 | 1950 |
| 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) | 24165 | 25375 | 21610 | 23250 |

**Table 6.2.5.3-2: IMD analysis for V2X\_n78A-n47A**

The harmonics and intermodulation products should be evaluated when V2X inter-band con-current operating UE coexists with other systems such as GNSS and ISM. The harmonics and IMD analysis of V2X\_n78A-n47A for GNSS and ISM bands is shown in table 6.2.5.3-3. Based on the analysis for GNSS and ISM bands, band n47 and 4th order IMD have an impact on the ISM band (5GHz).

**Table 6.2.5.3-3: Harmonic and IMDs analysis of V2X\_n78A-n47A UE for GNSS and ISM bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | Band n47, 4th order IMD |
| 5150 | - | 5350 | Yes | Europe | 4th order IMD |
| 5470 | - | 5725 | Yes | 4th order IMD |
| 5150 | - | 5825 | Yes | Asia | 4th order IMD |

### 6.2.6 V2X\_n8A-n47A

#### 6.2.6.1 Operating bands for V2X\_n8A-n47A

The operating bands for V2X\_n8A-n47A are specified in table 6.2.6.1-1.

**Table 6.2.6.1-1: Inter-band con-current V2X operating bands for V2X\_n8A-n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n8A\_n47A | n8 | Uu | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.2.6.2 Channel bandwidths per operating band for V2X\_n8A-n47A

The channel bandwidths per operating band for V2X\_n8A-n47A are specified in table 6.2.6.2-1.

**Table 6.2.6.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n8A-n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **35 MHz** | **40 MHz** | **45 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n8A-n47A | n8 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |  |  |  | 75 | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| n47 | 15 |  | Yes |  | Yes |  | Yes |  | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes |  | Yes |  | Yes |  | Yes |  |  |  |  |  |  |  |
| 60 |  | Yes |  | Yes |  | Yes |  | Yes |  |  |  |  |  |  |  |

#### 6.2.6.3 Coexistence studies

The harmonics analysis for V2X\_n8A-n47A is specified in table 6.2.6.3-1. Up to 7th harmonics of band n8 are provided since the frequency range of the 8th harmonics is much higher than 5.9GHz. The harmonics of band n47 are not listed as the harmonics distributed in the frequency range much higher than 5.9GHz have no impact on GNSS and ISM bands. Based on the harmonics analysis, it is observed that the harmonics of band n8 have no impact on band n47.

**Table 6.2.6.3-1: Harmonics analysis for V2X\_n8A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Band n8 | | Band n47 | |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 880 | 915 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | No effect | |
| 2nd harmonics frequency limits (MHz) | 1760 | 1830 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | No effect | |
| 3rd harmonics frequency limits (MHz) | 2640 | 2745 |
| 4th harmonics frequency limits | 4\*fx\_low | 4\*fx\_high | No effect | |
| 4th harmonics frequency limits (MHz) | 3520 | 3660 |
| 5th harmonics frequency limits | 5\*fx\_low | 5\*fx\_high | No effect | |
| 5th harmonics frequency limits (MHz) | 4400 | 4575 |
| 6th harmonics frequency limits | 6\*fx\_low | 6\*fx\_high | No effect | |
| 6th harmonics frequency limits (MHz) | 5280 | 5490 |
| 7th harmonics frequency limits | 7\*fx\_low | 7\*fx\_high | No effect | |
| 7th harmonics frequency limits (MHz) | 6160 | 6405 |

The IMD analysis for V2X\_n8A-n47A is specified in table 6.2.6.3-2. Up to the 5th order IMDs of band n8 and band n47 are provided. Based on the IMD analysis, it is observed that no IMD products fall into the associated bands.

| **Operating Band** | **Band n8** | | **Band n47** | |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 880 | 915 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 1760 | 1830 | 11710 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 2640 | 2745 | 17565 | 17775 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 4940 | 5045 | 6735 | 6840 |
| 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) | 4165 | 4025 | 10795 | 10970 |
| 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) | 7615 | 7755 | 12590 | 12765 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 3285 | 3110 | 16650 | 16895 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 8495 | 8670 | 18445 | 18690 |
| 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) | 10090 | 9880 | 13470 | 13680 |
| 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) | 22820 | 22505 | 2195 | 2405 |
| 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) | 24300 | 24615 | 9445 | 9585 |
| 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) | 16015 | 15735 | 8965 | 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) | 19325 | 19605 | 14350 | 14595 |

**Table 6.2.6.3-2: IMD analysis for V2X\_n8A-n47A**

The harmonics and intermodulation products should be evaluated when V2X inter-band con-current operating UE coexists with other systems such as GNSS and ISM. The harmonics and IMD analysis of V2X\_n8A-n47A for GNSS and ISM bands is shown in table 6.2.6.3-3. Based on the analysis for GNSS and ISM bands, band n47 and 6th harmonics have an impact on the ISM band (5GHz).

**Table 6.2.6.3-3: Harmonic and IMDs analysis of V2X\_n8A-n47A UE for GNSS and ISM bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | Band n47 |
| 5150 | - | 5350 | Yes | Europe | 6th harmonic |
| 5470 | - | 5725 | Yes | 6th harmonic |
| 5150 | - | 5825 | Yes | Asia | 6th harmonic |

### 6.2.7 V2X\_n1A-n47A

#### 6.2.7.1 Operating bands for V2X\_n1A-n47A

The operating bands for V2X\_n1A-n47A are specified in table 6.2.7.1-1.

**Table 6.2.7.1-1: Inter-band con-current V2X operating bands for V2X\_n1A-n47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n1A\_n47A | n1 | Uu | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| n47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.2.7.2 Channel bandwidths per operating band for V2X\_n1A-n47A

The channel bandwidths per operating band for V2X\_n1A-n47A are specified in table 6.2.7.2-1.

**Table 6.2.7.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n1A-n47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **45 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n1A-n47A | n1 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 90 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  |
| n47 | 15 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |  |  |
| 30 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |  |  |
| 60 |  | Yes |  | Yes |  | Yes | Yes |  |  |  |  |  |  |  |

#### 6.2.7.3 Coexistence studies

The harmonics analysis for V2X\_n1A-n47A is specified in table 6.2.7.3-1. The 2nd and 3rd harmonics of band n1 are provided since the frequency range of the 4th harmonics is much higher than 5.9GHz. The harmonics of band n47 are not listed as the harmonics distributed in the frequency range much higher than 5.9GHz have no impact on GNSS and ISM bands. Based on the harmonics analysis, it is observed that the 3rd harmonics of band n1 fall into band n47.

**Table 6.2.7.3-1: Harmonics analysis for V2X\_n1A-n47A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating Band | Band n1 | | Band n47 | |
| UE UL carriers | fx\_low | fx\_high | fy\_low | fy\_high |
| UL frequency (MHz) | 1920 | 1980 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | No effect | |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3rd harmonics fall into Band n47 | |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 |

The IMD analysis for V2X\_n1A-n47A is specified in table 6.2.7.3-2. Up to the 5th order IMDs of band n1 and band n47 are provided. Based on the IMD analysis, it is observed that 5th IMD products fall into band n47.

| **Operating Band** | **Band n1** | | **Band n47** | |
| --- | --- | --- | --- | --- |
| **UE UL carriers** | **fx\_low** | **fx\_high** | **fy\_low** | **fy\_high** |
| UL frequency (MHz) | 1920 | 1980 | 5855 | 5925 |
| 2nd harmonics frequency limits | 2\*fx\_low | 2\*fx\_high | 2\* fy\_low | 2\* fy\_high |
| 2nd harmonics frequency limits (MHz) | 3840 | 3960 | 11710 | 11850 |
| 3rd harmonics frequency limits | 3\*fx\_low | 3\*fx\_high | 3\* fy\_low | 3\* fy\_high |
| 3rd harmonics frequency limits (MHz) | 5760 | 5940 | 17565 | 17775 |
| Two tone 2nd order IMD products | |fy\_low – fx\_high| | |fy\_high – fx\_low| | |fy\_low + fx\_low| | |fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 3875 | 4005 | 7775 | 7905 |
| 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) | 2085 | 1895 | 9730 | 9930 |
| 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) | 9695 | 9885 | 13630 | 13830 |
| Two-tone 4th order IMD products | |3\*fx\_low – fy\_high| | |3\*fx\_high – fy\_low| | |3\*fy\_low – fx\_high| | |3\*fy\_high – fx\_low| |
| IMD frequency limits (MHz) | 165 | 85 | 15585 | 15855 |
| Two-tone 4th order IMD products | |3\*fx\_low + fy\_low| | |3\*fx\_high + fy\_high| | |3\*fy\_low + fx\_low| | |3\*fy\_high + fx\_high| |
| IMD frequency limits (MHz) | 11615 | 11865 | 19485 | 19755 |
| 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) | 8010 | 7750 | 15550 | 15810 |
| 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) | 21780 | 21440 | 2065 | 1755 |
| 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) | 25340 | 25680 | 13535 | 13845 |
| 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) | 13935 | 13605 | 5770 | 6090 |
| 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) | 21405 | 21735 | 17470 | 17790 |

**Table 6.2.7.3-2: IMD analysis for V2X\_n1A-n47A**

The harmonics and intermodulation products should be evaluated when V2X inter-band con-current operating UE coexists with other systems such as GNSS and ISM. The harmonics and IMD analysis of V2X\_n1A-n47A for GNSS and ISM bands is shown in table 6.2.7.3-3. Based on the analysis for GNSS and ISM bands, band n47 and 4th order IMD have an impact on the ISM band (5GHz).

**Table 6.2.7.3-3: Harmonic and IMDs analysis of V2X\_n1A-n47A UE for GNSS and ISM bands**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Victim Systems** | **Frequency range [MHz]** | | | **Impact** | **Regions** | **Comments** |
| COMPASS  (Beidou) | 1559 | - | 1591 | No |  |  |
| Galileo | 1559 | - | 1591 | No |  |  |
| GLONASS | 1591 | - | 1610 | No |  |  |
| GPS | 1563 | - | 1587 | No |  |  |
| ISM band  (2.4GHz) | 2400 | - | 2483.5 | No | US/Europe |  |
| 2400 | - | 2494 | No | Asia |  |
| ISM band  (5GHz) | 5150 | - | 5925 | Yes | US | Band n47, 3rd harmonics, 5th order IMD |
| 5150 | - | 5350 | No | Europe |  |
| 5470 | - | 5725 | Yes | 5th order IMD |
| 5150 | - | 5825 | Yes | Asia | 3rd harmonics, 5th order IMD |

6.2.7.4 MSD

MSD test configurations are specified below for V2X\_n1A-n47A. The MSD values given in tables 6.2.7.4-1

**Table 6.2.7.4-1: Reference sensitivity exceptions (MSD) due to cross band isolation for NR V2X**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **SL band** | **SCS of UL/DL band (kHz)** | **LCRB of UL band** | **UL band BW(MHz)** | **LCRB of SL band** | **SL band BW (MHz)** | **MSD value of SL band (dB)** |
| n1 | n47 | 60 | 30 | 40 | 50 | 10 | 20.1 |
| n1 | n47 | 60 | 30 | 40 | 105 | 20 | 16.3 |
| n1 | n47 | 60 | 30 | 40 | 160 | 30 | 14.7 |
| n1 | n47 | 60 | 30 | 40 | 216 | 40 | 13.2 |

## 6.3 Con-current operation between one NR Uu band and one LTE PC5 band

### 6.3.1 V2X\_n39A\_47A

#### 6.3.1.1 Operating bands for V2X\_n39A\_47A

The operating bands for V2X\_n39A\_47A are specified in table 6.3.1.1-1.

**Table 6.3.1.1-1: Inter-band con-current V2X operating bands for V2X\_n39A\_47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n39A\_47A | n39 | Uu | 1880 MHz | – | 1920 MHz | 1880 MHz | – | 1920 MHz | TDD |
| 47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.3.1.2 Channel bandwidths per operating band for V2X\_n39A\_47A

The channel bandwidths per operating band for V2X\_n39A\_47A are specified in table 6.3.1.2-1.

**Table 6.3.1.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n39A\_47A**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n39A\_47A | n39 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | 60 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes |
| 47 | 15 |  | Yes |  | Yes |  |  |  |

#### 6.3.1.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n39A-n47A in clause 6.2.1.3 are applicable to V2X\_n39A\_47A since band 47 and band n47 have the same frequency range.

### 6.3.2 V2X\_n40A\_47A

#### 6.3.2.1 Operating bands for V2X\_n40A\_47A

The operating bands for V2X\_n40A\_47A are specified in table 6.3.2.1-1.

**Table 6.3.2.1-1: Inter-band con-current V2X operating bands for V2X\_n40A\_47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR OperatingBand** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n40A\_47A | n40 | Uu | 2300 MHz | – | 2400 MHz | 2300 MHz | – | 2400 MHz | TDD |
| 47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.3.2.2 Channel bandwidths per operating band for V2X\_n40A\_47A

The channel bandwidths per operating band for V2X\_n40A\_47A are specified in table 6.3.2.2-1.

**Table 6.3.2.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n40A\_47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **80 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n40A\_47A | n40 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  | 100 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 47 | 15 |  | Yes |  | Yes |  |  |  |  |  |  |

#### 6.3.2.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n40A-n47A in clause 6.2.2.3 are applicable to V2X\_n40A\_47A since band 47 and band n47 have the same frequency range.

### 6.3.3 V2X\_n41A\_47A

#### 6.3.3.1 Operating bands for V2X\_n41A\_47A

The operating bands for V2X\_n41A\_47A are specified in table 6.3.3.1-1.

**Table 6.3.3.1-1: Inter-band con-current V2X operating bands for V2X\_n41A\_47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR OperatingBand** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n41A\_47A | n41 | Uu | 2496 MHz | – | 2690 MHz | 2496 MHz | – | 2690 MHz | TDD |
| 47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.3.3.2 Channel bandwidths per operating band for V2X\_n41A\_47A

The channel bandwidths per operating band for V2X\_n41A\_47A are specified in table 6.3.3.2-1.

**Table 6.3.3.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n41A\_47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n41A\_47A | n41 | 15 |  | Yes | Yes | Yes |  | Yes | Yes | Yes |  |  |  |  |  | 120 | 0 |
| 30 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes |  | Yes | Yes | Yes | Yes |  | Yes | Yes | Yes |
| 47 | 15 |  | Yes |  | Yes |  |  |  |  |  |  |  |  |  |

#### 6.3.3.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n40A-n47A in clause 6.2.2.3 are applicable to V2X\_n40A\_47A since band 47 and band n47 have the same frequency range.

### 6.3.4 V2X\_n79A\_47A

#### 6.3.4.1 Operating bands for V2X\_n79A\_47A

The operating bands for V2X\_n79A\_47A are specified in table 6.3.4.1-1.

**Table 6.3.4.1-1: Inter-band con-current V2X operating bands for V2X\_n79A\_47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n79A\_47A | n79 | Uu | 4400 MHz | – | 5000 MHz | 4400 MHz | – | 5000 MHz | TDD |
| 47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.3.4.2 Channel bandwidths per operating band for V2X\_n79A\_47A

The channel bandwidths per operating band for V2X\_n79A\_47A are specified in table 6.3.4.2-1.

**Table 6.3.4.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n79A\_47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n79A\_47A | n79 | 15 |  |  |  |  |  |  | Yes | Yes |  |  |  |  | 120 | 0 |
| 30 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 60 |  |  |  |  |  |  | Yes | Yes | Yes | Yes |  | Yes |
| 47 | 15 |  | Yes |  | Yes |  |  |  |  |  |  |  |  |

#### 6.3.4.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n79A\_47A in clause 6.2.4.3 are applicable to V2X\_n79A\_47A since band 47 and band n47 have the same frequency range.

#### 6.3.4.4 MSD

The REFSENS exception due to cross band isolation can be observed for V2X\_n79A\_47A. One MSD test configuration is specified as below for each band combination. The MSD values given in tables 6.3.4.4-1and 6.3.4.4-2 shall apply for all n79 and n47 BWs and SCSs combinations given in table 6.3.4.2-1.

Table 6.3.4.4-1: Reference sensitivity exceptions (MSD) due to cross band isolation for V2X band

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| UL band | SL reception band | SCS of UL/DL band (kHz) | LCRB of UL band | UL band BW(MHz) | LCRB of DL band | DL band BW (MHz) | MSD value of DL band (dB) |
| n79 | 47 | 15 | 216 | 40 | 50 | 10 | 3.3 |

**Table 6.3.4.4-2: Reference sensitivity exceptions (MSD) due to cross band isolation for Uu band**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **SL transmission band** | **DL band** | **SCS of UL/DL band (kHz)** | **LCRB of SL transmission band** | **SL transmission BW(MHz)** | **LCRB of DL band** | **DL band BW (MHz)** | **MSD value of DL band (dB)** |
| 47 | n79 | 15 | 50 | 10 | 216 | 40 | 3.3 |

### 6.3.5 V2X\_n78A\_47A

#### 6.3.5.1 Operating bands for V2X\_n78A\_47A

The operating bands for V2X\_n78A\_47A are specified in table 6.3.5.1-1.

**Table 6.3.5.1-1: Inter-band con-current V2X operating bands for V2X\_n78A\_47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n78A\_47A | n78 | Uu | 3300 MHz | – | 3800 MHz | 3300 MHz | – | 3800 MHz | TDD |
| 47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.3.5.2 Channel bandwidths per operating band for V2X\_n78A\_47A

The channel bandwidths per operating band for V2X\_n78A\_47A are specified in table 6.3.5.2-1.

**Table 6.3.5.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n78A\_47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **50 MHz** | **60 MHz** | **70 MHz** | **80 MHz** | **90 MHz** | **100 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n78A\_47A | n78 | 15 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |  |  |  |  | 120 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 47 | 15 |  | Yes |  | Yes |  |  |  |  |  |  |  |  |  |

#### 6.3.5.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n78A\_47A in clause 6.2.5.3 are applicable to V2X\_n78A\_47A since band 47 and band n47 have the same frequency range.

### 6.3.6 V2X\_n8A\_47A

#### 6.3.6.1 Operating bands for V2X\_n8A\_47A

The operating bands for V2X\_n8A\_47A are specified in table 6.3.6.1-1.

**Table 6.3.6.1-1: Inter-band con-current V2X operating bands for V2X\_n8A\_47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n8A\_47A | n8 | Uu | 880 MHz | – | 915 MHz | 925 MHz | – | 960 MHz | FDD |
| 47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.3.6.2 Channel bandwidths per operating band for V2X\_n8A\_47A

The channel bandwidths per operating band for V2X\_n8A\_47A are specified in table 6.3.6.2-1.

**Table 6.3.6.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n8A\_47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **35 MHz** | **40 MHz** | **45 MHz** | **50 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n8A\_47A | n8 | 15 | Yes | Yes | Yes | Yes |  |  | Yes |  |  |  | 60 | 0 |
| 30 |  | Yes | Yes | Yes |  |  | Yes |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |
| 47 | 15 |  | Yes |  | Yes |  |  |  |  |  |  |

#### 6.3.6.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n8A-n47A in clause 6.2.6.3 are applicable to V2X\_n8A\_47A since band 47 and band n47 have the same frequency range.

### 6.3.7 V2X\_n1A\_47A

#### 6.3.7.1 Operating bands for V2X\_n1A\_47A

The operating bands for V2X\_n1A\_47A are specified in table 6.3.7.1-1.

**Table 6.3.7.1-1: Inter-band con-current V2X operating bands for V2X\_n1A\_47A**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X con-current configuration** | **E-UTRA / NR Operating Band** | **Interface** | **Uplink (UL) band** | | | **Downlink (DL) band** | | | **Duplex Mode** |
| **BS receive / UE transmit** | | | **BS transmit / UE receive** | | |
| **FUL\_low – FUL\_high** | | | **FDL\_low – FDL\_high** | | |
| V2X\_n1A\_47A | n1 | Uu | 1920 MHz | – | 1980 MHz | 2110 MHz | – | 2170 MHz | FDD |
| 47 | PC5 | 5855 MHz | – | 5925 MHz | 5855 MHz | – | 5925 MHz | HD |

#### 6.3.7.2 Channel bandwidths per operating band for V2X\_n1A\_47A

The channel bandwidths per operating band for V2X\_n1A\_47A are specified in table 6.3.7.2-1.

**Table 6.3.7.2-1: V2X inter-band con-current configurations and bandwidth combination sets for V2X\_n1A\_47A**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **V2X inter-band Configuration** | **E-UTRA / NR operating Band** | **SCS kHz** | **5 MHz** | **10 MHz** | **15 MHz** | **20 MHz** | **25 MHz** | **30 MHz** | **40 MHz** | **45 MHz** | **50 MHz** | **Maximum aggregated bandwidth [MHz]** | **Bandwidth combination set** |
| V2X\_n1A\_47A | n1 | 15 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | 70 | 0 |
| 30 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 60 |  | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 47 | 15 |  | Yes |  | Yes |  |  |  |  |  |

#### 6.3.7.3 UE co-existence studies

The UE co-existence studies specified for V2X\_n1A-n47A in clause 6.2.7.3 are applicable to V2X\_n1A\_47A since band 47 and band n47 have the same frequency range.

6.3.7.4 MSD

MSD test configurations are specified below for V2X\_n1A-47A. The MSD values are given in table 6.3.7.4-1. The MSD values given below shall apply to all n1 and 47 BW and SCS combinations.

**Table 6.3.7.4-1: Reference sensitivity exceptions (MSD) due to cross band isolation for V2X**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **UL band** | **SL band** | **SCS of UL/DL band (kHz)** | **LCRB of UL band** | **UL band BW(MHz)** | **LCRB of SL band** | **SL band BW (MHz)** | **MSD value of SL band (dB)** |
| n1 | 47 | 15 | 50 | 10 | 50 | 10 | 16.6 |
| n1 | 47 | 15 | 50 | 10 | 98 | 20 | 13.8 |

# 7 Other specification impacts (if applicable)

*Editor Note: If it is applicable, then it can be added in the future [FFS]*

Annex A:  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2020-08 | RAN4 #96e | R4-2011795 |  |  |  | TR skeleton for V2X new band combinations | 0.0.1 |
| 2021-02 | RAN4#98e | R4-2100502 |  |  |  | Implemented TPs approved in RAN4#96e and RAN4#97e are listed below:  R4-2011796, TP on harmonics and IMD analysis for V2X\_n39A-n47A con-current operation, CATT, RAN4#96e  R4-2016871, TP on V2X\_n40A-n47A coexistence study, CATT, RAN4#97e  R4-2017829, TP for TR 37.875 adding some UE RF study for NR V2X band combinations, Huawei, HiSilicon, RAN4#97e | 0.1.0 |
| 2021-02 | RAN4#98e | R4-2103198 |  |  |  | Implemented TP approved in RAN4#98e is listed below:  R4-2103199, TP on V2X\_n41A-n47A coexistence study, CATT, RAN4#98e | 0.2.0 |
| 2021-04 | RAN4#98bis-e | R4-2104772 |  |  |  | Implemented TP approved in RAN4#98bis-e is listed below:  R4-2104769, TP on V2X\_n79A-n47A and V2X\_n79A-47A coexistence study, CATT, RAN4#98bis-e | 0.3.0 |
| 2021-05 | RAN4#99-e | R4-2109043 |  |  |  | Implemented TPs approved in RAN4#99-e are listed below:  R4-2107814, Scope of NR V2X R17 combinations, Huawei, HiSilicon, RAN4#99-e  R4-2107815, Discussion and TP for TR 37.875 on MSD for V2X\_n79A-n47A and V2X\_n79A\_47A, Huawei, HiSilicon, RAN4#99-e  R4-2109038, TP on V2X\_n78A-n47A and V2X\_n78A-47A coexistence study, CATT, RAN4#99-e | 0.4.0 |
| 2021-08 | RAN4#100e | R4-2111950 |  |  |  | Implemented TP approved in RAN4#100-e is listed below:  R4-2111948, TP on V2X\_3A\_n47A coexistence study and band combos notation correction, CATT, RAN4#100-e | 0.5.0 |
| 2021-11 | RAN4#101e | R4-2120032 |  |  |  | Implemented TP approved in RAN4#100-e is listed below:  R4-2120032, TP for TR 37.875 on MSD for V2X\_n79A-n47A and V2X\_n79A\_47A, Huawei, HiSilicon, RAN4#101-e | 0.6.0 |