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| 3GPP TR 37.718-00-00 V0.1.0 (2022-08) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Radio Access Networks;  Band combinations for SA NR Supplementary uplink (SUL), NSA NR SUL, NSA NR SUL with UL sharing from the UE perspective (ULSUP);  (Release 18) | |
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# 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.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

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

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

**can** indicates that something is possible

**cannot** indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

# 1 Scope

The present document is a technical report for SA NR Supplementary uplink (SUL), NSA NR SUL and NSA NR SUL with UL sharing from the UE perspective (ULSUP) under Rel-18 time frame. The purpose is to gather the relevant background information and studies in order to address NR SUL for the Rel-18 bands/band combinations in Table 1-1 to Table 1-4.

Table 1-1: Release 18 SUL bands

|  |  |  |  |
| --- | --- | --- | --- |
| **Band number** | **UL** | **DL** | **Duplex mode** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Table 1-2: Release 18 SA SUL band combinations

|  |  |
| --- | --- |
| **SA SUL band combination** | **REL independent from** |
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Table 1-3: Release 18 NSA SUL band combinations

|  |  |
| --- | --- |
| **NSA SUL band combination** | **REL independent from** |
|  |  |

Table 1-4: Release 18 NSA SUL with ULSUP band combinations

|  |  |
| --- | --- |
| **NSA SUL with ULSUP band combination** | **REL independent from** |
|  |  |

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

# 2 References

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

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

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

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

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

[2] RP-221839, "New WID: Rel-18 Band combinations for SA NR supplementary uplink (SUL), NSA NR SUL, NSA NR SUL with UL sharing from the UE perspective (ULSUP)", RAN#96

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

**example:** text used to clarify abstract rules by applying them literally.

## 3.2 Symbols

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

<symbol> <Explanation>

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

ΔTIB,c Allowed maximum configured output power relaxation due to support for inter-band CA operation, for serving cell *c*.

## 3.3 Abbreviations

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

<ABBREVIATION> <Expansion>

BS Base Station

BCS Bandwidth Combination Set

CA Carrier Aggregation

CC Component Carriers

DC Dual Connectivity

DL Downlink

E-UTRA Evolved UMTS Terrestrial Radio Access

FDD Frequency Division Duplex

MPR Allowed maximum power reduction

MSD Maximum Sensitivity Degradation

NR New Radio

NSA Non-Stand Alone

REFSENS Reference Sensitivity power level

SA Stand Alone

SCS Subcarrier spacing

SUL Supplementary uplink

TDD Time Division Duplex

UE User Equipment

UL Uplink

ULSUP UL sharing from the UE perspective

# 4 Background

The present document is a technical report for SA NR SUL, NSA NR SUL and NSA NR SUL with UL sharing from ULSUP under Rel-17 time frame. It covers both the UE and BS side. The document is divided in different parts:

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

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

- Specific NSA NR SUL with UL sharing from ULSUP part: this part covers each band combination and its specific issues independently from each other (i.e. one subclause is defined per band combination)

## 4.1 TR Maintenance

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

# 5 SA NR SUL band combination: Specific Band Combination Part

5.1 CA\_n1\_SUL\_n78-n81

5.1.1 Operating bands

**Table 5.1.1-1: SUL band combination**

|  |  |
| --- | --- |
| NR Band combination for SUL | NR Band  (Table 5.2-1) |
| CA\_n1\_SUL\_n78-n81 | n1, n78, n81 |
| NOTE 1: If a UE is configured with both NR UL and NR SUL carriers in a cell, the switching time between NR UL carrier and NR SUL carrier is 0 us.  NOTE 2: For UE supporting SUL band combination simultaneous Rx/Tx capability is mandatory. | |

5.1.2 Channel bandwidths per operating band

**Table 5.1.2-1: Supported bandwidths per SUL band combination**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SUL band combination with CA** | **UL configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | **Bandwidth combination set** |
| CA\_n1A\_SUL\_n78A-n81A | SUL\_n78A-n81A | n1 | 5, 10, 15, 20, 25, 30, 40, 50 | 0 |
| n78 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 |
| n81 | 5, 10, 15, 20 |
| NOTE 1: The SCS of each channel bandwidth for NR band refers to Table 5.3.5-1. | | | | |

5.1.3 Maximum output power

There is only single UL in uplink so the requirement for each band in clause 6.2.1 from 38.101-1 is applicable.

5.1.4 Spurious emission band UE co-existence

There is only single UL in uplink so the requirement for each band in clause 6.5.3.2 from 38.101-1 is applicable.

5.1.5 REFSENS requirements

For SUL operation with CA, the reference receive sensitivity (REFSENS) requirement for downlink bands specified in clause 7.3A.2 from TS 38.101-1 shall be met when supplementary uplink configuration for reference sensitivity are specified as below.

Table 5.1.5-1: Supplementary uplink configuration for reference sensitivity

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | NR Band / SCS of SUL band / Channel bandwidth of the DL band / NRB | | | | | | | | | | | | | | |
| DL band | SUL band | SCS of SUL band  (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 |
| n1 | n81 | 15 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |  |  |  |  |  |
| n78 | n81 | 15 |  | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
|  | | | | | | | | | | | | | | | |

Since the 4th harmonic interference of SUL band n81 may fall into the Rx band n78, the MSD due to harmonic interference should be took care of. The REFSENS requirements can refer to the MSD due to harmonic interference between SUL band n81 and n78 which has been specified in Table 7.3C.2-2, if harmonic interference need to be considered.

5.1.6 ∆TIB and ∆RIB values

For CA\_n1\_SUL\_n78-n81, the ΔTIB,c and ΔRIB,c values are given in the tables below referring to CA\_n1-n8-n78.

**Table 5.1.6-1: ΔTIB,c**

| SUL Band combination | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
| CA\_n1\_SUL\_n78-n81 | n1 | 0.3 |
| n78 | 0.8 |
| n81 | 0.6 |

**Table 5.1.6-2: ΔRIB,c**

| SUL Band combination | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
| CA\_n1\_SUL\_n78-n81 | n1 | 0 |
| n78 | 0.5 |

5.2 CA\_n3\_SUL\_n41-n80

5.2.1 Operating bands

**Table 5.2.1-1: SUL band combination**

|  |  |
| --- | --- |
| NR Band combination for SUL | NR Band  (Table 5.2-1) |
| CA\_n3\_SUL\_n41-n80 | n3, n41, n80 |
| NOTE 1: If a UE is configured with both NR UL and NR SUL carriers in a cell, the switching time between NR UL carrier and NR SUL carrier is 0 us.  NOTE 2: For UE supporting SUL band combination simultaneous Rx/Tx capability is mandatory. | |

5.2.2 Channel bandwidths per operating band

**Table 5.2.2-1: Supported bandwidths per SUL band combination**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SUL band combination with CA** | **UL configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | **Bandwidth combination set** |
| CA\_n3A\_SUL\_n41C-n80A | SUL\_n41C-n80A | n3 | 5, 10, 15, 20, 25, 30, 40 | 0 |
| n41 | See CA\_n41C Bandwidth Combination Set 1 in Table 5.5A.1-1 |
| n80 | 5, 10, 15, 20, 25, 30, 40 |
| NOTE 1: The SCS of each channel bandwidth for NR band refers to Table 5.3.5-1. | | | | |

5.2.3 Maximum output power

There is only single UL in uplink so the requirement for each band in clause 6.2.1 or 6.2A.1.1 from 38.101-1 is applicable.

5.2.4 Spurious emission band UE co-existence

The requirements have been studied in clause 5.20.4 from TR 37.717-00-00.

5.2.5 REFSENS requirements

The requirements for UL configurations have been studied in clause 5.20.5 from TR 37.717-00-00 and MSD due to cross band isolation has been specified in the spec. For UL configuration SUL\_n41C-n80A of CA\_n3A\_SUL\_n41C-n80A, we can get the IMD order for contiguous UL CA as below referring to clause 7.3.2.2 from TR 38.862.

WGap = lowest band edge of n41 - highest DL band edge of n3 = 2496 – 1880 = 616 MHz.

Min(maxUL aggregated BW, UL band bandwidth) = Min(190, 194) = 190 MHz.

IMD order = 2\*ceil(WGap /Min(maxUL aggregated BW, UL band bandwidth) + 1 = 9.

Since IMD order is < 11, MSD should be considered.

The Reference sensitivity exception due to intermodulation interference can be same as DL\_n3A-n41C\_UL\_n41C. Thus, there is no need to specify it into specification again assuming that the fall back configuration would specify the same requirements.

**Table 5.2.5-1: Reference sensitivity exception due to intermodulation interference**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Band / Channel bandwidth / NRB / Duplex mode | | | | | | | | Source of IMD |
| NR CA band combination | NR band | UL Fc  (MHz) | UL/DL BW  (MHz) | UL  LCRB | DL Fc (MHz) | MSD  (dB) | Duplex mode |  |
|  | n3 | N/A | 5 | N/A | 1830 | 5.2 | FDD | IMD9 |
| CA\_n3A\_SUL\_n41C-n80A | n41 | 2550 | 100 | 1 (RBSTART=24) | 2550 | N/A | TDD | N/A |
|  |  | 2645 | 90 | 1 (RBSTART=218) | 2645 |  |  |  |
|  | n80 | 1735 | 5 | 25 | N/A | N/A | SUL | N/A |

5.2.6 ∆TIB and ∆RIB values

The requirements have been studied in clause 5.20.6 from TR 37.717-00-00.

## 5.Y SUL\_nX-nY/CA\_nX\_SUL\_nY-nZ

### 5.Y.1 Operating bands

**Table 5.Y.1-1: SUL band combination**

|  |  |
| --- | --- |
| NR Band combination for SUL | NR Band  (Table 5.2-1 from TS 38.101-1) |
|  |  |
|  | |

### 5.Y.2 Configuration

**Table 5.Y.2-1: Supported bandwidths per SUL band combination**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SUL band combination with CA** | **UL configuration** | **NR Band** | **Channel bandwidth (MHz) (NOTE 1)** | **Bandwidth combination set** |
|  |  |  |  | 0 |
|  |  |
|  |  |
| NOTE 1: The SCS of each channel bandwidth for NR band refers to Table 5.3.5-1 from TS 38.101-1. | | | | |

### 5.Y.3 Maximum output power

*<Editor’s note: This requirement is only applicable when there is simultaneous transmission in the band combination.>*

### 5.Y.4 Spurious emission band UE co-existence

*<Editor’s note: This requirement is only applicable when there is simultaneous transmission in the band combination.>*

### 5.Y.5 REFSENS requirements

### 5.Y.6 ∆TIB and ∆RIB values

**Table 5.25.1.6-1: ΔTIB,c**

| SUL Band combination | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
|  |  |  |
|  |  |
|  |  |

**Table 5.25.1.6-2: ΔRIB,c**

| SUL Band combination | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
|  |  |  |
|  |  |

### 5.Y.7 Out-of-band blocking exception

*<Editor’s note: This requirement is only applicable when there is Out-of-band blocking exception in the band combination.>*

# 6 NSA NR SUL band combination: Specific Band Combination Part

## 6.Y DC\_X\_SUL\_nY-nZ

### 6.Y.1 Operating bands

### 6.Y.2 Configuration

### 6.Y.3 Maximum output power

### 6.Y.4 Spurious emission band UE co-existence

### 6.Y.5 REFSENS requirements

### 6.Y.6 ∆TIB and ∆RIB values

# 7 NSA NR SUL with UL sharing from ULSUP band combination: Specific Band Combination Part

## 7.Y DC\_28\_SUL\_n41-n83

### 7.Y.1 Configuration

Table 7.Y.2-1: Inter-band EN-DC configurations

| EN-DC  configuration | Uplink EN-DC  configuration  (NOTE 1) |
| --- | --- |
|  |  |

### 7.Y.2 Maximum output power

Table 7.Y.2-1: Maximum output power for inter-band EN-DC

| DC configuration | Power class X  (dBm) | Tolerance  (dB) |
| --- | --- | --- |
|  |  |  |

### 7.Y.3 Spurious emission band UE co-existence

Table 7.Y.3-1: Spurious emissions for inter-band EN-DC

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EN-DC Configuration** | **Spurious emission** | | | | | | |
| **Protected band** | **Frequency range (MHz)** | | | **Maximum Level (dBm)** | **MBW (MHz)** | **NOTE** |
|  |  |  |  |  |  |  |  |
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### 7.Y.4 MSD

### 7.Y.5 ∆TIB and ∆RIB values

Table 7.Y.5-1: ΔTIB,c

| EN-DC Band combination | NR Band | ΔTIB,c [dB] |
| --- | --- | --- |
|  |  |  |
|  |  |
|  |  |

Table 7.Y.5-2: ΔRIB,c

| EN-DC Band combination | NR Band | ΔRIB,c [dB] |
| --- | --- | --- |
|  |  |  |
|  |  |

Annex <A> (informative):  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Change history | | | | | | | |
| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment | New version |
| 2022-08 | 3GPP RAN4#104-e | R4-2213057 |  |  |  | Initial TR skeleton | 0.0.1 |
| 2022-08 | 3GPP RAN4#104-e | R4-2213058 |  |  |  | Implemented TP’s from RAN4#104e  R4-2213128 TP for 37.718-00-00 to introduce SUL configuration CA\_n1A\_SUL\_n78A-n81A Huawei, HiSilicon  R4-2213129 TP for 37.718-00-00 to add SUL configuration SUL\_n41C-n80A for CA\_n3A\_SUL\_n41C-n80A Huawei, HiSilicon | 0.1.0 |