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**5G;
NR;
Requirements on User Equipments (UEs)
supporting a release-independent frequency band
(3GPP TS 38.307 version 15.10.0 Release 15)**



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Foreword

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

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 - 1 presented to TSG for information;
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 - 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 specifies requirements for Rel-15 UEs supporting release independent features like:

- additional NR operating bands and power classes on top of Rel-15 of TS 38.101 [2-5] and TS 38.133 [6];

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 38.101-1: NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone
- [3] 3GPP TS 38.101-2: NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone
- [4] 3GPP TS 38.101-3: NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios
- [5] 3GPP TS 38.101-4: NR; User Equipment (UE) radio transmission and reception; Part 4: UE performance requirements
- [6] 3GPP TS 38.133: NR; Requirements for support of radio resource management
- [7] 3GPP TS 38.306: NR; User Equipment (UE) radio access capabilities

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].

release independent: applicable to some frozen releases, starting from a certain release Rel-M

NOTE 1: Normally, a feature is introduced only in the latest open release Rel-N and future releases are based on the previous one so that future releases inherit the requirements of this feature. Introducing a feature "in a release independent way from Rel-M onwards" ($M < N$) means it was decided by TSG RAN that this feature would be also beneficial in previous, already frozen releases starting with Rel-M until Rel-(N-1). In order to avoid touching TS 38.101 [2-5] or TS 38.133 [6] of these frozen releases, the corresponding requirements are captured in TS 38.307 via pointers to [2-5] or [6] of the release in which the feature was introduced.

NOTE 2: Release independent does not mean applicable to all releases.

3.2 Symbols

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

N	Release in which a feature is introduced into TS 38.101 [2-5] or TS 38.133 [6]
M	Release from which onwards (including release M) a feature is release independent

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].

BW	Bandwidth
CA	Carrier Aggregation
CC	Component carrier
DL	Downlink
EN-DC	Dual connectivity between E-UTRA and NR
FDD	Frequency Division Duplex
FR1	Frequency range 1
FR2	Frequency range 2
NR	New radio
PMI	Precoding Matrix Indicator
REL	Release
SDL	Supplementary downlink
SUL	Supplementary uplink
TDD	Time Division Duplex
UE	User Equipment
UL	Uplink

4 General

TSG-RAN has agreed for certain features (see the following clauses) to introduce them in a "release independent way".

This means for each feature:

- it is "introduced" in a release N, i.e. TS 38.101 [2-5] and TS 38.133 [6] of release N define certain UE requirements for this feature; the feature is indicated in the tables of the following clauses;
- it is "release independent" starting from a release M ($M < N$); M for the given feature is provided in the tables of the following clauses;
- UEs supporting this feature have to fulfil additional requirements in release M or higher which are specified in one or more Annexes of TS 38.307 of release N; the applicable Annexes for a given feature are provided in the tables of the following clauses.

The applicable UE Categories are specified in TS 38.306 [7] according to the release to which the UE conforms.

In the table of release independent features in subsequent clauses, "FDD, TDD" refers to CA or EN-DC configuration composed by only FDD bands or only TDD bands, respectively. "FDD and TDD" refers to CA or EN-DC configuration including both FDD and TDD bands. "SDL and FDD, SDL and TDD" refers to CA configuration including both SDL and FDD bands or both SDL and TDD bands, respectively. "TDD and SUL" refers to SUL configuration including both TDD and SUL bands. "FDD and TDD and SUL" refers to EN-DC configuration including both FDD, TDD and SUL bands. Unless stated otherwise, the release independent for the band combinations are from Rel-15.

When a new feature is introduced only the latest release of release independent spec needs to be updated. The latest release of release independent spec refers to the release which the new feature is introduced in. If an RF feature introduced in the same release as the release which the feature is independent from, (i.e. $M=N$), the common UE RF requirements table in annex B.4 is specified from release N+1, otherwise the common UE RF requirements table is specified from release N.

5 Release independent features for NR frequency range 1

5.1 Additional NR operating bands and UE power classes for NR frequency range 1

Requirements for a Rel-15 UE for additional NR operating bands power classes and UE channel bandwidth compared to TS 38.101-1 of Rel-15 [2] are introduced via this clause.

Table 5.1-1: NR operating bands

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Operating bands	FDD, TDD, SDL, SUL	Rel-15	

Table 5.1-2: NR UE power class

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the power class was introduced)
Power Class 1	FDD	Rel-15	
Power Class 2	TDD	Rel-15	
Power Class 3	FDD, TDD, SUL	Rel-15	

Table 5.1-3: NR UE channel bandwidth

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the UE channel bandwidth was introduced)
UE channel bandwidth	FDD, TDD, SUL, SDL	Rel-15	

5.2 Additional NR CA configurations for NR frequency range 1

5.2.1 Intra-band CA

Requirements for a Rel-15 UE for additional NR intraband CA configurations within FR1 compared to TS 38.101-1 of Rel-15 [2] are introduced via this clause.

Table 5.2.1-1: NR intra-band CA within FR1

Feature	DL/UL	CA BW Class	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band contiguous CA configurations within FR1	DL	C, D, E, G, H, I, J, K, L	TDD	Rel-15	
	UL	A	TDD	Rel-15	

5.2.2 Inter-band CA

Requirements for a Rel-15 UE for additional NR inter-band CA configurations within FR1 compared to TS 38.101-1 of Rel-15 [2] are introduced via this clause.

Table 5.2.2-1: NR inter-band CA within FR1

Feature	DL/UL	Maximum number of bands	number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band CA configurations within NR FR1	DL	2	2	A	TDD, FDD, SDL and FDD, SDL and TDD	Rel-15	
	UL	2	2	A	TDD, FDD and TDD	Rel-15	

5.3 Additional NR SUL configurations for NR frequency range 1

Requirements for a Rel-15 UE for additional NR SUL configurations within FR1 compared to TS 38.101-1 of Rel-15 [2] are introduced via this clause.

Table 5.3-1: NR SUL within FR1

Feature	DL/UL	number of bands	number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the SUL configuration was introduced)
Inter-band SUL configurations within NR FR1	DL	1	1	A	TDD	Rel-15	
	UL	2	2	A	TDD and SUL	Rel-15	

5.4 Other release independent features for NR frequency range 1

This clause covers requirements for a Rel-15 UE coming from all other release independent features that are not covered under clause 5.1, 5.2 and 5.3, e.g. generic baseband requirements or requirements that are not band/CA/SUL configuration specific.

Table 5.4-1: Additional requirements of other release independent features

Feature	Release independent from	Requirements to be fulfilled (see 38.307 of the REL when the feature was introduced)	Further information
RRM requirements for high speed train scenario	Rel-15 (NOTE 1)	Table C.1-1	Rel-16 WI NR_HST introduced band independent RRM requirements: see Table C.1-1
UE demodulation requirements for high speed train scenario	Rel-15 (NOTE 1)	Table C.2-1	Rel-16 WI NR_HST introduced band independent UE demodulation requirements: see Table C.2-1
RF requirements for 4Rx UEs	Rel-15		
NOTE 1: Rel-15 UEs supporting the high speed train are assumed to read the Rel-16 high speed train scenario information, which is broadcast to all UEs.			

5.5 Other release independent requirements for NR frequency range 1

This clause covers requirements for a Rel-15 UE coming from all other release independent requirements with the corresponding features introduced in Rel-15.

Table 5.5-1: Release independent requirements with the corresponding features introduced in Rel-15

Feature	Release independent from	Requirements to be fulfilled (see 38.307 of the REL when the feature was introduced)	Further information
Precoding matrix indicator (PMI) reporting requirements for TypeI-SinglePanel and TypeII Codebooks with more than 8TX and up to 32TX	Rel-15	Table D.1-1, Table D.2-1	Rel-16 NR_perf_enh-Perf WI introduced band independent PMI reporting requirements for 16TX and 32TX TypeI-SinglePanel Codebook, and 16TX TypeII Codebook.
PDSCH demodulation requirements with LTE CRS rate matching for TDD band	Rel-15	Table E.1-1	Rel-16 NR_perf_enh-Perf WI introduced band independent PDSCH demodulation requirements with LTE CRS rate matching for TDD band.

6 Release independent features for NR frequency range 2

6.1 Additional NR operating bands and UE power classes for NR frequency range 2

Requirements for a Rel-15 UE for additional NR operating bands power classes and UE channel bandwidth compared to TS 38.101-2 of Rel-15 [3] are introduced via this clause.

Table 6.1-1: NR operating bands

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Operating bands	TDD	Rel-15	

Table 6.1-2: NR UE power class

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Power Class 1, 2, 3, 4	TDD	Rel-15	

Table 6.1-3: NR UE channel bandwidth

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the UE channel bandwidth was introduced)
UE channel bandwidth	TDD	Rel-15	

6.2 Additional NR CA configurations for NR frequency range 2

6.2.1 Intra-band CA

Requirements for a Rel-15 UE for additional NR intra-band CA configurations within FR2 compared to TS 38.101-2 of Rel-15 [3] are introduced via this clause.

Table 6.2.1-1: NR intra-band contiguous CA within FR2

Feature	DL/UL	CA BW Class	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band contiguous CA configurations within FR2	DL	B, C, D, E, F, G, H, I, J, K, L, M, O, P, Q	TDD	Rel-15	
	UL	B, D, E, F, G, H, I, J, K, L, M, O, P, Q	TDD	Rel-15	

Table 6.2.1-2: NR non-contiguous intra-band CA within FR2

Feature	DL/UL	number of sub-blocks	maximum number of CCs within a sub-block	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band non-contiguous CA configurations within FR2	DL	2	4	TDD	Rel-15	
		3	1	TDD	Rel-15	
		4	1	TDD	Rel-15	

7 Release independent features for NR interworking between NR frequency range 1 and NR frequency range 2

7.1 Additional NR inter-band CA configurations between frequency range 1 and frequency range 2

Requirements for a Rel-15 UE for additional NR inter-band CA configurations between FR1 and FR2 compared to TS 38.101-3 of Rel-15 [4] are introduced via this clause.

Table 7.1-1: NR inter-band CA between FR1 and FR2

Feature	DL/UL	number of bands	maximum number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band CA configurations for NR interworking between FR1 and FR2	DL FR1	1	2	A, C	FDD, TDD	Rel-15	
	DL FR2	1	4	A, D, E, F	TDD	Rel-15	
	UL FR1	1	1	A	FDD, TDD	Rel-15	
	UL FR2	1	1	A	TDD	Rel-15	

7.2 Additional Inter-band NR-DC configurations between frequency range 1 and frequency range 2

Requirements for a Rel-15 UE for additional Inter-band NR-DC configurations between FR1 and FR2 compared to TS 38.101-3 of Rel-15 [4] are introduced via this clause.

Table 7.2-1: Inter-band NR-DC between FR1 and FR2

Feature	DL/UL	number of bands	maximum number of CCs	CA BW Classes	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band DC configurations for NR interworking between FR1 and FR2	DL FR1	1	2	A, C	TDD	Rel-15	
	DL FR2	1	8	A, D, E, F, G, H, I, J, K, L, M	TDD	Rel-15	
	UL FR1	1	1	A	TDD	Rel-15	
	UL FR2	1	1	A	TDD	Rel-15	

8 Release independent features for NR interworking between NR and E-UTRA

8.1 Additional EN-DC configurations

8.1.1 Intra-band EN-DC

Requirements for a Rel-15 UE for additional EN-DC intra-band configurations within FR1 compared to TS 38.101-3 of Rel-15 [4] are introduced via this clause.

Table 8.1.1-0: EN-DC intra-band UE power class

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Intra-band contiguous EN-DC power class 2	TDD	Rel-15	
Intra-band contiguous EN-DC power class 3	FDD, TDD	Rel-15	
Intra-band non-contiguous EN-DC power class 2	TDD	Rel-15	
Intra-band non-contiguous EN-DC power class 3	FDD, TDD	Rel-15	

Table 8.1.1-1: EN-DC contiguous intra-band configurations within FR1

Feature	DL/UL	maximum number of E-UTRA CCs	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band contiguous EN-DC	DL	3	1	FDD, TDD	Rel-15	
	UL	1	1	FDD, TDD	Rel-15	

Table 8.1.1-2: EN-DC non-contiguous intra-band configurations within FR1

Feature	DL/UL	maximum number of sub-blocks	maximum number of E-UTRA CCs	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Intra-band EN-DC	DL	2	3	1	FDD, TDD	Rel-15	
	UL	2	1	1	FDD, TDD	Rel-15	

8.1.2 Inter-band EN-DC

8.1.2.1 Inter-band EN-DC within frequency range 1

Requirements for a Rel-15 UE for additional EN-DC interband configurations within FR1 compared to TS 38.101-3 of Rel-15 [4] are introduced via this clause.

Table 8.1.2.1-0: EN-DC inter-band UE power class

Feature	Duplex-mode	Release independent from	Requirements to be fulfilled (see TS 38.307 of the release in which the band was introduced)
Inter-band EN-DC Power Class 2	TDD	Rel-15	Table B.4.6-1
Inter-band EN-DC Power Class 3	FDD, TDD, FDD and TDD	Rel-15	

Table 8.1.2.1-1: EN-DC inter-band configurations without SUL within FR1

Feature	DL/UL	maximum number of E-UTRA bands	maximum number of E-UTRA CCs	maximum number of NR bands	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band EN-DC	DL	4	5	2	2	FDD, TDD, FDD and TDD	Rel-15	
	UL	1	2	1	1	FDD, TDD, FDD and TDD	Rel-15	

Table 8.1.2.1-2: EN-DC inter-band configurations with SUL within FR1

Feature	DL/UL	maximum number of E-UTRA bands	maximum number of E-UTRA CCs	maximum number of NR bands	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band EN-DC	DL	2	3	1	1	FDD, TDD, FDD and TDD	Rel-15	
	UL	1	1	2	2	FDD, TDD, FDD and TDD, FDD and TDD and SUL	Rel-15	

8.1.2.2 Inter-band EN-DC including frequency range 2

Requirements for a Rel-15 UE for additional EN-DC inter-band configurations including FR2 compared to TS 38.101-3 of Rel-15 [4] are introduced via this clause.

Table 8.1.2.2-1: EN-DC inter-band configurations including FR2

Feature	DL/UL	number of E-UTRA bands	maximum number of E-UTRA CCs	number of NR bands	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band EN-DC	DL	4	5	1	8	TDD, FDD and TDD	Rel-15	
	UL	1	2	1	8	TDD, FDD and TDD	Rel-15	

8.1.2.3 Inter-band EN-DC including frequency range 1 and frequency range 2

Requirements for a Rel-15 UE for additional EN-DC inter-band configurations including FR1 and FR2 compared to TS 38.101-3 of Rel-15 [4] are introduced via this clause.

Table 8.1.2.3-1: EN-DC inter-band configurations including FR1 and FR2

Feature	DL/UL	maximum number of E-UTRA bands	maximum number of E-UTRA CCs	maximum number of NR bands	maximum number of NR CCs	Duplex-mode	Release independent from	requirements to be fulfilled (see 38.307 of the REL in which the CA configuration was introduced)
Inter-band EN-DC	DL FR1	4	4	1	2	TDD, FDD	Rel-15	
	DL FR2			1	4	TDD	Rel-15	
	UL FR1	1	1	1	1	FDD, TDD	Rel-15	
	UL FR2			1	1	TDD,	Rel-15	

Annex A (informative): Frequency arrangement for overlapping operating bands

The following information is provided in order to assist a UE derive the DL NR-ARFCN and UL NR-ARFCN in a multi-band environment, in which multiple overlapping operating bands may be indicated in the fields *freqBandIndicatorNR* and *MultiFrequencyBandListNR-SIB*.

The overlapping bands, independent of release, which may be indicated in a cell are shown in Table A-1 for applicable NR operating bands. The DL NR-ARFCN and UL NR-ARFCN are derived according to TS 38.101-1 Rel-15.

Table A-1: Overlapping bands (multi-band environments) for each NR band

NR Operating Band	Overlapping NR operating bands	Duplex Mode
n2	n25	FDD
n25	n2	FDD
n38	n41	TDD
n41	n38	TDD
n77	n78	TDD
n78	n77	TDD
n80	n86	SUL
n86	n80	SUL

Annex B (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2017-09	RAN4#85	R4-1712166				Skeleton TS	0.0.1
2018-03	RAN4#86	R4-1802107				TS 38.307 v0.1.0	0.1.0
2018-06	RAN#80	RP-180988				v1.0.0 submitted for plenary approval	1.0.0
2018-06	RAN#80					Approved by plenary – Rel-15 spec under change control	15.0.0
2018-09	RAN#81	RP-181896	0001		F	CR for FR2 Power Classes in TS38.307	15.1.0
2018-12	RAN#82	RP-182362	0002	2	B	CR for TS 38.307	15.2.0
2019-06	RAN#84	RP-191237	0005		B	Addition of missing features for TS 38.307	15.3.0
2019-12	RAN#86	RP-193019	0010		B	CR for REL-15 TS 38.307 for PC2 EN-DC TDD+TDD	15.4.0
2019-12	RAN#86	RP-193036	0013		F	Adding SDL to 38.307	15.4.0
2020-03	RAN#87	RP-200404	0017	1	B	38.307 CR power class REL-15	15.5.0
2020-06	RAN#88	RP-200986	0021		F	Maintenance CR to 38307 on a reference spec number R15	15.6.0
2020-12	RAN#90	RP-202485	0039		F	CR to TS 38.307 Release independence support of new channel bandwidth from Rel-15	15.7.0
2020-12	RAN#90	RP-202485	0031	1	F	CR on adding NR overlapping bands list in TS38.307 in Rel-15	15.7.0
2020-12	RAN#90	RP-202422	0033	1	B	CR on release independent for Rel.16 NR HST RRM requirements	15.7.0
2020-12	RAN#90	RP-202422	0034	1	B	CR on release independent for Rel.16 NR HST UE demodulation requirements	15.7.0
2021-03	RAN#91	RP-210065	0043	1	B	Draft CR for TS 38.307 on UE demodulation performance requirements (Rel-15)	15.8.0
2021-03	RAN#91	RP-210078	0046		F	CR on release independent for Rel-16 NR HST UE demodulation requirements	15.8.0
2021-09	RAN#93	RP-211921	0069		F	CR to TS 38.307 on the definition of the duplex-mode for the band configurations	15.9.0
2022-03	RAN#95	RP-220337	0091		F	Big CR for TS 38.307 Maintenance (Rel-15)	15.10.0
2022-03	RAN#95	RP-220352	0094		F	CR for release independent for 4Rx support for NR band	15.10.0

History

Document history		
V15.0.0	July 2018	Publication
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V15.2.0	April 2019	Publication
V15.3.0	July 2019	Publication
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V15.7.0	January 2021	Publication
V15.8.0	April 2021	Publication
V15.9.0	October 2021	Publication
V15.10.0	May 2022	Publication