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User Equipment (UE) radio transmission and reception;
Part 3: Range 1 and Range 2 Interworking operation
with other radios
(3GPP TS 38.101-3 version 15.30.0 Release 15)**



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Foreword

This Technical Specification 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:

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- x the first digit:
 - 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.
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1 Scope

The present document establishes the minimum RF requirements for NR User Equipment (UE) Interworking operation with other radios. This includes but is not limited to additional requirements for carrier aggregation or NR dual connectivity between Range 1 and Range 2 and additional requirements due to NR non-standalone (NSA) operation mode with E-UTRA.

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 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"
- [5] 3GPP TS 38.521-3: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios"
- [6] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000"
- [7] 3GPP TS 36.211: "E-UTRA; Physical channels and modulation"
- [8] 3GPP TS 36.331: " Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification"
- [9] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification"
- [10] 3GPP TS 38.213: "NR; Physical layer procedures for control"
- [11] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities"
- [12] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".
- [13] 3GPP TS 38.211: "NR; Physical channels and modulation".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP 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 3GPP TR 21.905 [1].

3.2 Symbols

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

$\Delta R_{IB,c}$	Allowed reference sensitivity relaxation due to support for CA or DC operation, for serving cell c .
$\Delta T_{IB,c}$	Allowed maximum configured output power relaxation due to support for CA or DC operation, for serving cell c
$BW_{E-UTRA_Channel}$	Channel bandwidth of E-UTRA carrier
$BW_{E-UTRA_Channel_CA}$	Channel bandwidth of E-UTRA sub-block which is composed of intra-band contiguous CA E-UTRA carriers
$BW_{NR_Channel}$	Channel bandwidth of NR carrier
$BW_{NR_Channel_CA}$	Channel bandwidth of NR sub-block which is composed of intra-band contiguous CA NR carriers
$Ceil(x)$	Rounding upwards; $ceil(x)$ is the smallest integer such that $ceil(x) \geq x$
$EN-DC_{ACLR}$	The ratio of the filtered mean power centred on the aggregated sub-block bandwidth ENBW to the filtered mean power centred on an adjacent bandwidth of the same size ENBW
$E-UTRA_{ACLR}$	E-UTRA ACLR
F_C	<i>RF reference frequency</i> for the carrier center on the channel raster
F_{DL_low}	The lowest frequency of the downlink <i>operating band</i>
F_{DL_high}	The highest frequency of the downlink <i>operating band</i>
F_{UL_low}	The lowest frequency of the uplink <i>operating band</i>
F_{UL_high}	The highest frequency of the uplink <i>operating band</i>
F_{OOB}	The boundary between the NR out of band emission and spurious emission domains
L_{CRB}	Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resource blocks
$Max()$	The largest of given numbers
$Min()$	The smallest of given numbers
NR_{ACLR}	NR ACLR
N_{RB}	Transmission bandwidth configuration, expressed in units of resource blocks
N_{RB_agg}	The number of the aggregated RBs within the fully allocated aggregated channel bandwidth $N_{RB_agg} = \sum_1^j N_{RB_j} * 2^{\mu_j}$ for carrier 1 to j , where μ is defined in TS 38.211 [13]
$N_{RB,c}$	The transmission bandwidth configuration of component carrier c , expressed in units of resource blocks $N_{RB,cj} = N_{RB_j} * 2^{\mu_j}$ for carrier j , where μ is defined in TS 38.211 [13]
P_{CMAX}	The configured maximum UE output power
RB_{start}	Indicates the lowest RB index of transmitted resource blocks
W_{gap}	The sub-block gap between the two sub-blocks

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity
A-MPR	Additional Maximum Power Reduction
BCS	Bandwidth Combination Set
CA	Carrier Aggregation

CC	Component Carrier
DC	Dual Connectivity
EN-DC	E-UTRA/NR DC
EVM	Error Vector Magnitude
FDM	Frequency Division Multiplexing
FR	Frequency Range
ENBW	The aggregated bandwidth of an E-UTRA sub-block and an adjacent NR sub-block
ITU-R	Radiocommunication Sector of the International Telecommunication Union
MBW	Measurement bandwidth defined for the protected band
MPR	Allowed maximum power reduction
MSD	Maximum Sensitivity Degradation
MCG	Master Cell Group
NR	New Radio
NS	Network Signalling
NSA	Non-Standalone, a mode of operation where operation of an other radio is assisted with an other radio
OOB	Out-of-band
OOBE	Out-of-band emission
OTA	Over The Air
PRB	Physical Resource Block
RE	Resource Element
REFSENS	Reference Sensitivity
RF	Radio Frequency
Rx	Receiver
SCG	Secondary Cell Group
SCS	Subcarrier spacing
SEM	Spectrum Emission Mask
SUL	Supplementary uplink
TDM	Time Division Multiplex
Tx	Transmitter
UE	User Equipment
UL MIMO	Up Link Multiple Antenna transmission
ULSUP	Uplink sharing from UE perspective

4 General

4.1 Relationship between minimum requirements and test requirements

The present document is interwork specification for NR UE, covering RF characteristics and minimum performance requirements. Conformance to the present specification is demonstrated by fulfilling the test requirements specified in the conformance specification 3GPP TS 38.521-3 [5].

The Minimum Requirements given in this specification make no allowance for measurement uncertainty. The test specification TS 38.521-3 [5] defines test tolerances. These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in this specification to create test requirements. For some requirements, including regulatory requirements, the test tolerance is set to zero.

The measurement results returned by the test system are compared - without any modification - against the test requirements as defined by the shared risk principle.

The shared risk principle is defined in Recommendation ITU-R M.1545 [6].

4.2 Applicability of minimum requirements

- a) In this specification the Minimum Requirements are specified as general requirements and additional requirements. Where the Requirement is specified as a general requirement, the requirement is mandated to be met in all scenarios

- b) For specific scenarios for which an additional requirement is specified, in addition to meeting the general requirement, the UE is mandated to meet the additional requirements.
- c) The spurious emissions power requirements are for the long-term average of the power. For the purpose of reducing measurement uncertainty it is acceptable to average the measured power over a period of time sufficient to reduce the uncertainty due to the statistical nature of the signal
- d) Terminal that supports EN-DC configuration shall meet E-UTRA requirements as specified in TS 36.101 [4] and NR requirements as in TS 38.101-1 [2] and TS 38.101-2 [3] unless otherwise specified in this specification
- e) All the requirements for intra-band contiguous and non-contiguous EN-DC apply under the assumption of the same uplink-downlink and special subframe configurations in the E-UTRA and slot format indicated by UL-DL-configurationCommon and UL-DL-configurationDedicated in the NR for the EN-DC, a time offset between the two RATs configurations may be required.
- f) For EN-DC combinations with CA configurations for E-UTRA and/or NR, all the requirements for E-UTRA and/or NR all the requirements for E-UTRA and/or NR intra-band contiguous and non-contiguous CA apply under the assumption of the same slot format indicated by UL-DL-configurationCommon and UL-DL-configurationDedicated in the PSCell and SCells for NR and the same uplink-downlink and special subframe configurations in Pcell and SCells for E-UTRA.

A terminal which supports an EN-DC configuration shall support:

If any subsets of the EN-DC configuration do not specify its own bandwidth combination sets in 5.3B, then the terminal shall support the same E-UTRA bandwidth combination sets it signals the support for in E-UTRA CA configuration part of E-UTRA – NR DC and shall support the same NR bandwidth combination sets it signals the support for in NR CA configuration part of E-UTRA – NR DC.

Else if one of the subsets of the EN-DC configuration specify its own bandwidth combination sets in 5.3B, then the terminal shall support a product set of channel bandwidth for each band specified by E-UTRA bandwidth combination sets, NR bandwidth combination sets, and EN-DC bandwidth combination sets it signals the support.

A terminal which supports an inter-band EN-DC configuration with a certain UL configuration shall support the all lower order DL configurations of the lower order EN-DC combinations, which have this certain UL configuration and the fallbacks of this UL configuration.

For CA or DC configurations, which include FR2 intra-band CA configurations with multiple FR2 sub-blocks, where at least one of the sub-blocks is a contiguous CA configuration:

- if the field *partialFR2-FallbackRX-Req* is not present, the UE shall meet all applicable UE RF requirements for the highest order CA configuration and all associated fallback CA configurations;
- if the field *partialFR2-FallbackRX-Req* is present, for each FR2 intra-band CA configuration with multiple sub-blocks that the UE indicates support for explicitly in UE capability signalling: the in-gap UE RF requirements in clauses 7.5A, 7.5B, 7.6A, 7.6B apply as the equivalent requirements for the associated fallback FR2 intra-band CA configurations with the same number of sub-blocks, where at least one of the sub-blocks consists of a contiguous CA configuration. The UE shall meet all applicable UE RF requirements for fallback CA configurations with a lesser number of sub-blocks;
- regardless of the field *partialFR2-FallbackRX-Req*, the UE shall meet all DL out-of-gap requirements for all lower order fallback CA configurations.

Terminal that supports inter-band NR-DC between FR1 and FR2 configuration shall meet the requirements for corresponding CA configuration (suffix A), unless otherwise specified.

4.3 Specification suffix information

Unless stated otherwise the following suffixes are used for indicating at 2nd level clause, shown in Table 4.3-1.

Table 4.3-1: Definition of suffixes

Clause suffix	Variant
None	Single Carrier