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Part 3: Range 1 and Range 2 Interworking operation
with other radios
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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:
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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"

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
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

- 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
- 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.
- 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
- 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
- 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.
- 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 PCell and SCells for NR and the same uplink-downlink and special subframe configurations in Pcell and SCells for E-UTRA.