



TECHNICAL SPECIFICATION

**5G;  
NR;  
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 19.5.0 Release 19)**



---

**Reference**

RTS/TSGR-0438101-3vj50

---

**Keywords**

5G

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

---

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° w061004871

---

**Important notice**

The present document can be downloaded from the  
[ETSI Search & Browse Standards](#) application.

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on [ETSI deliver](#) repository.

Users should be aware that the present document may be revised or have its status changed, this information is available in the [Milestones listing](#).

If you find errors in the present document, please send your comments to the relevant service listed under [Committee Support Staff](#).

If you find a security vulnerability in the present document, please report it through our [Coordinated Vulnerability Disclosure \(CVD\)](#) program.

---

**Notice of disclaimer & limitation of liability**

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2026.  
All rights reserved.

# Contents

Foreword.....	14
1 Scope .....	16
2 References .....	16
3 Definitions, symbols and abbreviations .....	17
3.1 Definitions .....	17
3.2 Symbols.....	17
3.3 Abbreviations .....	17
4 General .....	18
4.1 Relationship between minimum requirements and test requirements .....	18
4.2 Applicability of minimum requirements .....	19
4.3 Specification suffix information.....	20
5 Operating bands and channel arrangement.....	20
5.1 General .....	20
5.2 Operating bands.....	20
5.2A Operating bands for CA .....	21
5.2A.1 Inter-band CA between FR1 and FR2.....	21
5.2B Operating bands for DC .....	25
5.2B.1 General.....	25
5.2B.2 Void .....	26
5.2B.3 Void .....	26
5.2B.4 Void .....	26
5.2B.5 Void .....	26
5.2B.6 Void .....	26
5.2B.7 Void .....	26
5.2E Operating bands for V2X .....	26
5.2E.1 Intra-band V2X bands.....	26
5.2E.2 Inter-band V2X bands.....	26
5.3 UE Channel bandwidth .....	27
5.3A UE Channel bandwidth for CA .....	27
5.3A.1 Inter-band CA between FR1 and FR2.....	27
5.3B UE Channel bandwidth for DC .....	27
5.3B.0 General.....	27
5.3B.1 Intra-band EN-DC in FR1.....	28
5.3B.1.1 General .....	28
5.3B.1.2 BCS for Intra-band contiguous EN-DC .....	28
5.3B.1.3 BCS for Intra-band non-contiguous EN-DC .....	32
5.3B.1a Intra-band NE-DC in FR1.....	37
5.3B.1a.1 General .....	37
5.3B.1a.2 BCS for Intra-band contiguous NE-DC .....	37
5.3B.1b Void.....	38
5.3B.1c Void.....	38
5.3C Void.....	38
5.3D Void.....	38
5.3E UE Channel bandwidth for V2X .....	38
5.3E.0 General.....	38
5.3E.1 Intra-band contiguous V2X in FR1.....	39
5.3E.2 Intra-band non-contiguous V2X in FR1 .....	39
5.3E.3 Inter-band V2X in FR1 .....	39
5.4 Void.....	39
5.4A Channel arrangement for CA.....	39
5.4B Channel arrangement for DC.....	40
5.4B.0 General.....	40
5.4B.1 Channel spacing for intra-band EN-DC carriers .....	40
5.5 Configuration .....	40
5.5A Configuration for CA .....	40
5.5A.1 Inter-band CA configurations between FR1 and FR2.....	40
5.5A.1.0 General .....	41

5.5A.1.1	Inter-band CA configurations between FR1 and FR2 (two bands) .....	42
	Table 5.5A.1.1-1a ~ Table 5.5A.1.1-1g .....	42
	Table 5.5A.1.1-1h ~ Table 5.5A.1.1-1k .....	75
	Table 5.5A.1.1-1l ~ Table 5.5A.1.1-1p .....	109
5.5A.1.2	Inter-band CA configurations between FR1 and FR2 (three bands) .....	148
	Table 5.5A.1.2-1a .....	148
	Table 5.5A.1.2-1b .....	206
	Table 5.5A.1.2-1c .....	287
5.5A.1.3	Inter-band CA configurations between FR1 and FR2 (four bands) .....	360
5.5A.1.4	Inter-band CA configurations between FR1 and FR2 (five bands) .....	458
5.5B	Configuration for DC .....	482
5.5B.1	General .....	482
5.5B.2	Intra-band contiguous EN-DC .....	482
5.5B.2a	Intra-band contiguous NE-DC .....	483
5.5B.3	Intra-band non-contiguous EN-DC .....	483
5.5B.4	Inter-band EN-DC within FR1 .....	484
5.5B.4.1	Inter-band EN-DC configurations within FR1 (two bands) .....	485
5.5B.4.2	Inter-band EN-DC configurations within FR1 (three bands) .....	495
5.5B.4.3	Inter-band EN-DC configurations within FR1 (four bands) .....	545
5.5B.4.4	Inter-band EN-DC configurations within FR1 (five bands) .....	621
5.5B.4.5	Inter-band EN-DC configurations within FR1 (six bands) .....	665
5.5B.4a	Inter-band NE-DC within FR1 .....	674
5.5B.4a.1	Inter-band NE-DC configurations within FR1 (two bands) .....	674
5.5B.4a.2	Inter-band NE-DC configurations within FR1 (three bands) .....	675
5.5B.4a.3	Inter-band NE-DC configurations within FR1 (four bands) .....	676
5.5B.4a.4	Inter-band NE-DC configurations within FR1 (five bands) .....	677
5.5B.5	Inter-band EN-DC including FR2 .....	678
5.5B.5.1	Inter-band EN-DC configurations including FR2 (two bands) .....	678
5.5B.5.2	Inter-band EN-DC configurations including FR2 (three bands) .....	707
5.5B.5.3	Inter-band EN-DC configurations including FR2 (four bands) .....	748
5.5B.5.4	Inter-band EN-DC configurations including FR2 (five bands) .....	775
5.5B.5.5	Void .....	785
5.5B.5a	Inter-band NE-DC including FR2 .....	785
5.5B.5a.1	Inter-band NE-DC configurations including FR2 (two bands) .....	785
5.5B.5a.2	Inter-band NE-DC configurations including FR2 (three bands) .....	786
5.5B.5a.3	Inter-band NE-DC configurations including FR2 (four bands) .....	788
5.5B.5a.4	Inter-band NE-DC configurations including FR2 (five bands) .....	789
5.5B.6	Inter-band EN-DC including FR1 and FR2 .....	789
5.5B.6.1	Void .....	789
5.5B.6.2	Inter-band EN-DC configurations including FR1 and FR2 (three bands) .....	789
5.5B.6.3	Inter-band EN-DC configurations including FR1 and FR2 (four bands) .....	804
5.5B.6.4	Inter-band EN-DC configurations including FR1 and FR2 (five bands) .....	832
5.5B.6.5	Inter-band EN-DC configurations including FR1 and FR2 (six bands) .....	853
5.5B.6a	Inter-band NE-DC including FR1 and FR2 .....	858
5.5B.6a.1	Void .....	858
5.5B.6a.2	Inter-band NE-DC configurations including FR1 and FR2 (three bands) .....	858
5.5B.6a.3	Inter-band NE-DC configurations including FR1 and FR2 (four bands) .....	859
5.5B.6a.4	Inter-band NE-DC configurations including FR1 and FR2 (five bands) .....	862
5.5B.6a.5	Inter-band NE-DC configurations including FR1 and FR2 (six bands) .....	863
5.5B.7	Inter-band NR-DC between FR1 and FR2 .....	864
5.5B.7.0	General .....	864
5.5B.7.1	Inter-band NR-DC configurations between FR1 and FR2 (two bands) .....	864
5.5B.7.2	Inter-band NR-DC configurations between FR1 and FR2 (three bands) .....	885
5.5B.7.3	Inter-band NR-DC configurations between FR1 and FR2 (four bands) .....	915
5.5B.7.4	Inter-band NR-DC configurations between FR1 and FR2 (five bands) .....	921
5.5C	Void .....	922
5.5D	Void .....	922
5.5E	Configuration for V2X operation .....	922
5.5E.1	General .....	922
5.5E.2	Intra-band contiguous V2X operation in FR1 .....	922
5.5E.3	Intra-band non-contiguous V2X operation in FR1 .....	922
5.5E.4	Inter-band V2X operation in FR1 .....	922

5.5E.4.1	Inter-band V2X configurations within FR1 (two bands).....	922
6	Transmitter characteristics .....	924
6.1	General .....	924
6.2	Void.....	924
6.2A	Transmitter power for CA .....	924
6.2A.1	UE maximum output power for CA.....	924
6.2A.1.1	Inter-band CA between FR1 and FR2.....	924
6.2A.2	UE maximum output power reduction for CA.....	924
6.2A.2.1	Inter-band CA between FR1 and FR2.....	924
6.2A.3	UE additional maximum output power reduction for CA.....	924
6.2A.4	Configured output power for CA .....	924
6.2A.4.1	Configured output power level.....	924
6.2A.4.2	$\Delta T_{IB,c}$ for CA .....	925
6.2A.4.2.1	$\Delta T_{IB,c}$ for Inter-band CA between FR1 and FR2 .....	925
6.2B	Transmitter power for DC .....	925
6.2B.1	UE maximum output power for DC.....	925
6.2B.1.1	Intra-band contiguous EN-DC .....	925
6.2B.1.1a	Intra-band contiguous NE-DC .....	927
6.2B.1.2	Intra-band non-contiguous EN-DC .....	927
6.2B.1.3	Inter-band EN-DC within FR1 .....	928
6.2B.1.3a	Inter-band NE-DC within FR1 .....	936
6.2B.1.4	Inter-band EN-DC including FR2 .....	936
6.2B.1.4a	(Void).....	936
6.2B.1.5	Inter-band EN-DC including both FR1 and FR2 .....	936
6.2B.2	UE maximum output power reduction for DC.....	937
6.2B.2.0	General .....	937
6.2B.2.1	Intra-band contiguous EN-DC .....	937
6.2B.2.1.1	General .....	937
6.2B.2.1a	(Void) .....	937
6.2B.2.1.2	MPR for power class 3 and power class 2 .....	938
6.2B.2.2	Intra-band non-contiguous EN-DC .....	938
6.2B.2.2.1	General .....	938
6.2B.2.2.2	MPR for power class 3 and power class 2 .....	939
6.2B.2.3	Inter-band EN-DC within FR1 .....	940
6.2B.2.3a	Inter-band NE-DC within FR1 .....	940
6.2B.2.4	Inter-band EN-DC including FR2 .....	940
6.2B.2.4a	(Void).....	940
6.2B.2.5	Inter-band EN-DC including both FR1 and FR2 .....	940
6.2B.3	UE additional maximum output power reduction for EN-DC .....	940
6.2B.3.1	Intra-band contiguous EN-DC .....	940
6.2B.3.1.0	General .....	940
6.2B.3.1.1	A-MPR for DC_(n)71AA .....	940
6.2B.3.1.2	A-MPR for NS_04.....	942
6.2B.3.2	Intra-band non-contiguous EN-DC .....	944
6.2B.3.2.0	General .....	944
6.2B.3.2.1	A-MPR for NS_04.....	944
6.2B.3.3	Inter-band EN-DC within FR1 .....	946
6.2B.3.3A	Inter-band NE-DC within FR1 .....	950
6.2B.3.4	Inter-band EN-DC including FR2 .....	950
6.2B.3.4A	(Void).....	950
6.2B.3.5	Inter-band EN-DC including both FR1 and FR2 .....	950
6.2B.4	Configured output power for DC.....	950
6.2B.4.1	Configured output power level.....	950
6.2B.4.1.1	Intra-band contiguous EN-DC.....	950
6.2B.4.1.1a	Intra-band contiguous NE-DC.....	955
6.2B.4.1.2	Intra-band non-contiguous EN-DC.....	956
6.2B.4.1.3a	Inter-band NE-DC within FR1 .....	962
6.2B.4.1.4	Inter-band EN-DC including FR2 .....	965
6.2B.4.1.4a	(Void) .....	965
6.2B.4.1.5	Inter-band EN-DC including both FR1 and FR2.....	965
6.2B.4.2	$\Delta T_{IB,c}$ for DC .....	965

6.2B.4.2.0	General .....	965
6.2B.4.2.1	Intra-band contiguous EN-DC .....	965
6.2B.4.2.1a	(Void) .....	965
6.2B.4.2.2	Intra-band non-contiguous EN-DC .....	966
6.2B.4.2.3	Inter-band EN-DC within FR1 .....	966
6.2B.4.2.3.1	$\Delta T_{IB,c}$ for EN-DC two bands .....	966
6.2B.4.2.3.2	$\Delta T_{IB,c}$ for EN-DC three bands .....	971
6.2B.4.2.3.3	$\Delta T_{IB,c}$ for EN-DC four bands .....	989
6.2B.4.2.3.4	$\Delta T_{IB,c}$ for EN-DC five bands .....	1007
6.2B.4.2.3.5	$\Delta T_{IB,c}$ for EN-DC six bands .....	1015
6.2B.4.2.3a	Inter-band NE-DC within FR1 .....	1016
6.2B.4.2.4	Inter-band EN-DC including FR2 .....	1016
6.2B.4.2.4.1	$\Delta T_{IB,c}$ for EN-DC two bands .....	1016
6.2B.4.2.4.2	$\Delta T_{IB,c}$ for EN-DC three bands .....	1016
6.2B.4.2.4.3	$\Delta T_{IB,c}$ for EN-DC four bands .....	1016
6.2B.4.2.4.4	$\Delta T_{IB,c}$ for EN-DC five bands .....	1017
6.2B.4.2.4.5	Void .....	1017
6.2B.4.2.4a	(Void) .....	1017
6.2B.4.2.5	Inter-band EN-DC including both FR1 and FR2 .....	1017
6.2B.4.2.5.1	$\Delta T_{IB,c}$ for EN-DC three bands .....	1017
6.2B.4.2.5.2	$\Delta T_{IB,c}$ for EN-DC four bands .....	1017
6.2B.4.2.5.3	$\Delta T_{IB,c}$ for EN-DC five bands .....	1017
6.2B.4.2.5.4	$\Delta T_{IB,c}$ for EN-DC six bands .....	1017
6.2B.5	Configured output power for NR-DC .....	1017
6.2B.5.1	Configured output power level .....	1017
6.2B.5.1.1	Inter-band NR-DC between FR1 and FR2 .....	1017
6.2E	Transmitter power for V2X in FR1 .....	1017
6.2E.1	UE maximum output power for V2X .....	1018
6.2E.1.1	UE maximum output power for Intra-band contiguous V2X .....	1018
6.2E.1.2	UE maximum output power for Intra-band non-contiguous V2X .....	1018
6.2E.1.3	UE maximum output power for Inter-band V2X .....	1018
6.2E.2	UE maximum output power reduction for V2X .....	1019
6.2E.2.1	UE maximum output power reduction for Intra-band V2X .....	1019
6.2E.2.2	UE maximum output power reduction for Inter-band V2X .....	1019
6.2E.3	UE additional maximum output power reduction for V2X .....	1019
6.2E.3.1	UE additional maximum output power reduction for Intra-band V2X .....	1019
6.2E.3.2	UE additional maximum output power reduction for Inter-band V2X .....	1019
6.2E.4	Configured output power for V2X .....	1019
6.2E.4.1	UE configured output power for Intra-band V2X .....	1019
6.2E.4.2	UE configured output power for Inter-band V2X .....	1019
6.2H	Transmitter power for DC with UL MIMO .....	1020
6.2H.1	UE maximum output power for DC with UL MIMO .....	1020
6.2H.1.1	void .....	1020
6.2H.1.2	void .....	1020
6.2H.1.3	Inter-band EN-DC with UL MIMO within FR1 .....	1020
6.2H.2	UE maximum output power reduction for DC with UL MIMO .....	1024
6.2H.2.1	void .....	1024
6.2H.2.2	void .....	1024
6.2H.2.3	Inter-band EN-DC with UL MIMO within FR1 .....	1024
6.2H.3	UE additional maximum output power reduction for EN-DC with UL MIMO .....	1024
6.2H.3.1	void .....	1024
6.2H.3.2	void .....	1024
6.2H.3.3	Inter-band EN-DC with UL MIMO within FR1 .....	1024
6.2H.4	Configured output power for DC with UL MIMO .....	1024
6.2H.4.1	Configured output power level .....	1024
6.2H.4.1.1	void .....	1024
6.2H.4.1.2	void .....	1025
6.2L	Transmitter power for DC with Tx Diversity .....	1025
6.2L.1	UE maximum output power for DC with Tx Diversity .....	1025
6.2L.1.1	void .....	1025
6.2L.1.2	void .....	1025
6.2L.1.3	Inter-band EN-DC with Tx Diversity within FR1 .....	1025

6.2L.2	UE maximum output power reduction for DC with Tx Diversity .....	1028
6.2L.2.1	void .....	1028
6.2L.2.2	void .....	1028
6.2L.2.3	Inter-band EN-DC with Tx Diversity within FR1 .....	1028
6.2L.3	UE additional maximum output power reduction for EN-DC with Tx Diversity .....	1028
6.2L.3.1	void .....	1028
6.2L.3.2	void .....	1028
6.2L.3.3	Inter-band EN-DC with Tx Diversity within FR1 .....	1028
6.2L.4	Configured output power for DC with Tx Diversity .....	1028
6.2L.4.1	Configured output power level .....	1028
6.2L.4.1.1	void .....	1028
6.2L.4.1.2	void .....	1028
6.3	Output power dynamics .....	1029
6.3A	Output power dynamics for CA .....	1029
6.3B	Output power dynamics for DC .....	1029
6.3B.0	General .....	1029
6.3B.1	Output power dynamics for EN-DC with UL sharing from UE perspective .....	1029
6.3B.1.1	E-UTRA and NR switching time mask for TDM based UL sharing from UE perspective .....	1029
6.3B.1a	(Void) .....	1030
6.3B.2	Output power dynamics for intra-band EN-DC without dual PA capability .....	1031
6.3B.2a	(Void) .....	1031
6.3B.3	Output power dynamics for intra-band EN-DC with dual PA capability .....	1031
6.3B.3a	(Void) .....	1032
6.3B.4	Output power dynamics for switching between two uplink carriers .....	1032
6.3B.4.1	E-UTRA and NR switching time mask between two uplink carriers .....	1032
6.3B.5	Output power dynamics for inter-band EN-DC .....	1033
6.3E	Output power dynamics for V2X .....	1033
6.3E.1	General .....	1033
6.3E.2	Output power dynamics for intra-band V2X operation .....	1033
6.3E.3	Output power dynamics for inter-band V2X con-current operation .....	1034
6.3H	Output power dynamics for DC with UL MIMO .....	1034
6.3H.0	General .....	1034
6.3H.1	void .....	1034
6.3H.2	void .....	1034
6.3H.3	Output power dynamics for inter-band EN-DC with UL MIMO .....	1034
6.3L	Output power dynamics for DC with Tx Diversity .....	1034
6.3L.0	General .....	1034
6.3L.1	void .....	1035
6.3L.2	void .....	1035
6.3L.3	Output power dynamics for inter-band EN-DC with Tx Diversity .....	1035
6.4	Void .....	1035
6.4A	Transmit signal quality for CA .....	1035
6.4A.1	Frequency error for CA .....	1035
6.4A.2	Transmit modulation quality for CA .....	1035
6.4B	Transmit signal quality for DC .....	1035
6.4B.1	Frequency error for DC .....	1035
6.4B.1.1	Frequency error for Intra-band contiguous EN-DC .....	1035
6.4B.1.1a	Frequency error for Intra-band contiguous NE-DC .....	1035
6.4B.1.2	Frequency error for Intra-band non-contiguous EN-DC .....	1035
6.4B.1.3	Frequency error for inter-band EN-DC within FR1 .....	1036
6.4B.1.3a	Frequency error for inter-band NE-DC within FR1 .....	1036
6.4B.1.4	Frequency error for inter-band EN-DC including FR2 .....	1036
6.4B.1.4a	(Void) .....	1036
6.4B.1.5	Frequency error for inter-band EN-DC including both FR1 and FR2 .....	1036
6.4B.2	Transmit modulation quality for DC .....	1036
6.4B.2.1	Transmit modulation quality for Intra-band contiguous EN-DC .....	1036
6.4B.2.1.1	Error Vector Magnitude .....	1036
6.4B.2.1.2	Carrier leakage .....	1036
6.4B.2.1.3	In-band emissions .....	1036
6.4B.2.1a	Transmit modulation quality for Intra-band contiguous NE-DC .....	1037
6.4B.2.1a.1	Error Vector Magnitude .....	1037
6.4B.2.1a.2	Carrier leakage .....	1037

6.4B.2.1a.3	In-band emissions.....	1037
6.4B.2.2	Transmit modulation quality for Intra-band non-contiguous EN-DC.....	1037
6.4B.2.2.1	Error Vector Magnitude.....	1037
6.4B.2.2.2	Carrier leakage.....	1037
6.4B.2.2.3	In-band emissions.....	1037
6.4B.2.3a	Transmit modulation quality for Inter-band NE-DC within FR1.....	1038
6.4B.2.4	Transmit modulation quality for Inter-band EN-DC including FR2.....	1038
6.4B.2.4a	(Void).....	1038
6.4B.2.5	Transmit modulation quality for inter-band EN-DC including both FR1 and FR2.....	1038
6.4E	Transmit signal quality for V2X operation in FR1.....	1038
6.4E.1	Frequency error for V2X.....	1038
6.4E.2	Transmit modulation quality for V2X.....	1038
6.4E.2.1	Transmit modulation quality for Intra-band V2X.....	1038
6.4E.2.2.1	Error Vector Magnitude.....	1038
6.4E.2.2.2	Carrier leakage.....	1038
6.4E.2.2.3	In-band emissions.....	1039
6.4E.2.2	Transmit modulation quality for Inter-band V2X.....	1039
6.4H	Transmit signal quality for DC with UL MIMO.....	1039
6.4H.1	Frequency error for DC with UL MIMO.....	1039
6.4H.1.1	void.....	1039
6.4H.1.2	void.....	1039
6.4H.1.3	Frequency error for inter-band EN-DC with UL MIMO within FR1.....	1039
6.4H.2	Transmit modulation quality for DC with UL MIMO.....	1039
6.4H.2.1	void.....	1039
6.4H.2.2	void.....	1039
6.4H.2.3	Transmit modulation quality for inter-band EN-DC with UL MIMO within FR1.....	1039
6.4L	Transmit signal quality for DC with Tx Diversity.....	1039
6.4L.1	Frequency error for DC with Tx Diversity.....	1039
6.4L.1.1	void.....	1039
6.4L.1.2	void.....	1039
6.4L.1.3	Frequency error for inter-band EN-DC with Tx Diversity within FR1.....	1039
6.4L.2	Transmit modulation quality for DC with Tx Diversity.....	1040
6.4L.2.1	void.....	1040
6.4L.2.2	void.....	1040
6.4L.2.3	Transmit modulation quality for inter-band EN-DC with Tx Diversity within FR1.....	1040
6.5	Void.....	1040
6.5A	Output RF spectrum emissions for CA.....	1040
6.5A.1	Occupied bandwidth for CA.....	1040
6.5A.2	Out-of-band emissions for CA.....	1040
6.5A.3	Spurious emissions for CA.....	1040
6.5A.3.1	Inter-band CA between FR1 and FR2.....	1040
6.5A.4	Transmit intermodulation for CA.....	1040
6.5B	Output RF spectrum emissions for DC.....	1040
6.5B.1	Occupied bandwidth for EN-DC.....	1040
6.5B.1.1	Intra-band contiguous EN-DC.....	1040
6.5B.1.2	Intra-band non-contiguous EN-DC.....	1040
6.5B.1.3	Inter-band EN-DC within FR1.....	1041
6.5B.1.3a	(Void).....	1041
6.5B.1.4	Inter-band EN-DC including FR2.....	1041
6.5B.1.4a	(Void).....	1041
6.5B.1.5	Inter-band EN-DC including both FR1 and FR2.....	1041
6.5B.2	Out-of-band emissions for DC.....	1041
6.5B.2.1	Intra-band contiguous EN-DC.....	1041
6.5B.2.1.1	Spectrum emissions mask.....	1041
6.5B.2.1.2	Additional spectrum emissions mask.....	1042
6.5B.2.1.2.1	Requirements for network signalled value "NS_35".....	1042
6.5B.2.1.2.2	Requirements for network signalled value "NS_04".....	1042
6.5B.2.1.3	Adjacent channel leakage ratio.....	1042
6.5B.2.2	Intra-band non-contiguous EN-DC.....	1043
6.5B.2.2.1	Spectrum emissions mask.....	1043
6.5B.2.2.2	Additional spectrum emissions mask.....	1043
6.5B.2.2.3	Adjacent channel leakage ratio.....	1043

6.5B.2.3	Inter-band EN-DC within FR1 .....	1043
6.5B.2.3a	(Void).....	1043
6.5B.2.4	Inter-band EN-DC including FR2 .....	1043
6.5B.2.4a	Inter-band NE-DC including FR2 .....	1043
6.5B.2.5	Inter-band EN-DC including both FR1 and FR2 .....	1044
6.5B.3	Spurious emissions for DC .....	1044
6.5B.3.1	Intra-band contiguous EN-DC .....	1044
6.5B.3.1.1	General spurious emissions .....	1044
6.5B.3.1.2	Spurious emission band UE co-existence .....	1044
6.5B.3.2	Intra-band non-contiguous EN-DC .....	1044
6.5B.3.2.1	General spurious emissions .....	1045
6.5B.3.2.2	Spurious emission band UE co-existence .....	1045
6.5B.3.3	Inter-band EN-DC within FR1 .....	1045
6.5B.3.3.2	Spurious emission band UE co-existence .....	1046
6.5B.3.3a	Inter-band NE-DC within FR1 .....	1051
6.5B.3.3a.1	Void.....	1051
6.5B.3.3a.2	Spurious emission band UE co-existence .....	1051
6.5B.3.4	Inter-band EN-DC including FR2 .....	1052
6.5B.3.4.0	General spurious emission.....	1052
6.5B.3.4.1	Spurious emission band UE co-existence .....	1052
6.5B.3.4a	(Void).....	1053
6.5B.3.4a.1	(Void) .....	1053
6.5B.3.5	Inter-band EN-DC including both FR1 and FR2 .....	1053
6.5B.3.5.0	General spurious emission.....	1053
6.5B.3.5.1	Spurious emission band UE co-existence .....	1053
6.5B.4	Additional spurious emissions .....	1053
6.5B.4.1	General .....	1053
6.5B.4.1.1	Void.....	1053
6.5B.4.2	Intra-band contiguous EN-DC .....	1053
6.5B.4.2.1	Minimum requirement (network signalled value "NS_04") .....	1053
6.5B.4.3	Intra-band non-contiguous EN-DC .....	1054
6.5B.4.3.1	Minimum requirement (network signalled value "NS_04") .....	1054
6.5B.4.4	Inter-band EN-DC within FR1 .....	1054
6.5B.4.4a	(Void).....	1054
6.5B.4.5	Inter-band EN-DC including FR2 .....	1054
6.5B.4.6	Inter-band EN-DC including both FR1 and FR2 .....	1054
6.5B.5	Transmit intermodulation for DC .....	1054
6.5B.5.1	Intra-band contiguous EN-DC .....	1054
6.5B.5.1a	(Void).....	1054
6.5B.5.2	Intra-band non-contiguous EN-DC .....	1055
6.5B.5.3	Inter-band EN-DC within FR1 .....	1055
6.5B.5.3a	(Void).....	1055
6.5B.5.4	Inter-band EN-DC including FR2 .....	1055
6.5B.5.4a	(Void).....	1055
6.5B.5.5	Inter-band EN-DC including both FR1 and FR2 .....	1055
6.5E	Output RF spectrum emissions for V2X operation in FR1 .....	1055
6.5E.1	Occupied bandwidth .....	1055
6.5E.1.1	Intra-band V2X .....	1055
6.5E.1.2	inter-band V2X con-current operation .....	1055
6.5E.2	Out-of-band emissions.....	1055
6.5E.2.1	Intra-band V2X .....	1055
6.5E.2.2	Inter-band V2X con-current operation .....	1055
6.5E.3	Spurious emissions .....	1055
6.5E.3.1	Intra-band V2X .....	1055
6.5E.3.1.1	General spurious emissions .....	1056
6.5E.3.1.2	Spurious emission band UE co-existence .....	1056
6.5E.3.2	Inter-band V2X con-current operation .....	1056
6.5E.3.2.1	General spurious emissions .....	1056
6.5E.3.2.2	Spurious emission band UE co-existence .....	1056
6.5E.4	Transmit intermodulation .....	1057
6.5E.4.1	Intra-band V2X .....	1057
6.5E.4.2	Inter-band V2X con-current operation .....	1058

6.5H	Output RF spectrum emissions for DC with UL MIMO .....	1058
6.5H.1	Occupied bandwidth for EN-DC with UL MIMO .....	1058
6.5H.1.1	void .....	1058
6.5H.1.2	void .....	1058
6.5H.1.3	Inter-band EN-DC with UL MIMO within FR1 .....	1058
6.5H.2	Out-of-band emissions for DC with UL MIMO .....	1058
6.5H.2.1	void .....	1058
6.5H.2.2	void .....	1058
6.5H.2.3	Inter-band EN-DC with UL MIMO within FR1 .....	1058
6.5H.3	Spurious emissions for DC with UL MIMO .....	1058
6.5H.3.1	void .....	1058
6.5H.3.2	void .....	1058
6.5H.4	Additional spurious emissions for DC with UL MIMO .....	1058
6.5H.4.1	void .....	1058
6.5H.4.2	void .....	1058
6.5H.4.3	Inter-band EN-DC with UL MIMO within FR1 .....	1058
6.5H.5	Transmit intermodulation for DC with UL MIMO .....	1059
6.5H.5.1	void .....	1059
6.5H.5.2	void .....	1059
6.5H.5.3	Inter-band EN-DC with UL MIMO within FR1 .....	1059
6.5L	Output RF spectrum emissions for DC with Tx Diversity .....	1059
6.5L.1	Occupied bandwidth for EN-DC with Tx Diversity .....	1059
6.5L.1.1	void .....	1059
6.5L.1.2	void .....	1059
6.5L.1.3	Inter-band EN-DC with Tx Diversity within FR1 .....	1059
6.5L.2	Out-of-band emissions for DC with Tx Diversity .....	1059
6.5L.2.1	void .....	1059
6.5L.2.2	void .....	1059
6.5L.2.3	Inter-band EN-DC with Tx Diversity within FR1 .....	1059
6.5L.3	Spurious emissions for DC with Tx Diversity .....	1059
6.5L.3.1	void .....	1059
6.5L.3.2	void .....	1059
6.5L.3.3	Inter-band EN-DC with Tx Diversity within FR1 .....	1059
6.5L.4	Additional spurious emissions for DC with Tx Diversity .....	1060
6.5L.4.1	void .....	1060
6.5L.4.2	void .....	1060
6.5L.4.3	Inter-band EN-DC with Tx Diversity within FR1 .....	1060
6.5L.5	Transmit intermodulation for DC with Tx Diversity .....	1060
6.5L.5.1	void .....	1060
6.5L.5.2	void .....	1060
6.5L.5.3	Inter-band EN-DC with Tx Diversity within FR1 .....	1060
6.6B	Beam correspondence for DC .....	1060
6.6B.1	Void .....	1060
6.6B.2	Void .....	1060
6.6B.3	Void .....	1060
6.6B.4	Inter-band EN-DC including FR2 .....	1060
6.6B.4a	(Void) .....	1060
6.6B.5	Inter-band EN-DC including both FR1 and FR2 .....	1060
7	Receiver characteristics .....	1060
7.1	General .....	1060
7.2	Void .....	1062
7.3	Void .....	1062
7.3A	Reference sensitivity for CA .....	1062
7.3A.1	General .....	1062
7.3A.2	Reference sensitivity power level for CA .....	1062
7.3A.3	$\Delta R_{IB,c}$ for CA .....	1062
7.3A.3.1	$\Delta R_{IB,c}$ for Inter-band CA between FR1 and FR2 .....	1062
7.3A.4	Void .....	1063
7.3B	Reference sensitivity level for DC .....	1063
7.3B.1	General .....	1063
7.3B.2	Reference sensitivity for DC .....	1063

7.3B.2.1	Intra-band contiguous EN-DC .....	1063
7.3B.2.1a	(Void).....	1064
7.3B.2.2	Intra-band non-contiguous EN-DC .....	1064
7.3B.2.3	Inter-band EN-DC within FR1 .....	1065
7.3B.2.3.0	General .....	1065
7.3B.2.3.1	Reference sensitivity exceptions due to UL harmonic interference for EN-DC in NR FR1 .....	1068
7.3B.2.3.2	Reference sensitivity exceptions due to receiver harmonic mixing for EN-DC in NR FR1.....	1074
7.3B.2.3.3	Void.....	1078
7.3B.2.3.4	Reference sensitivity exceptions due to cross band isolation for EN-DC in NR FR1 .....	1078
7.3B.2.3.5	MSD for intermodulation interference due to dual uplink operation for EN-DC in NR FR1 .....	1080
7.3B.2.3.5.1	MSD test points for intermodulation interference due to dual uplink operation for PC3 EN-DC in NR FR1 involving two bands .....	1081
7.3B.2.3.5.2	MSD test points for intermodulation interference due to dual uplink operation for EN-DC in NR FR1 involving three bands .....	1089
7.3B.2.3.5.3	Void .....	1157
7.3B.2.3.5.4	MSD test points for intermodulation interference due to dual uplink operation for EN-DC in NR FR1 involving four bands.....	1157
7.3B.2.3a	Inter-band NE-DC within FR1 .....	1158
7.3B.2.3a.0	General .....	1158
7.3B.2.3a.1	Reference sensitivity exceptions due to UL harmonic interference for NE-DC in NR FR1 .....	1158
7.3B.2.3a.2	Reference sensitivity exceptions due to receiver harmonic mixing for NE-DC in NR FR1.....	1158
7.3B.2.3a.3	Reference sensitivity exceptions due to cross band isolation for NE-DC in NR FR1 .....	1158
7.3B.2.3a.4	MSD for intermodulation interference due to dual uplink operation for NE-DC in NR FR1 .....	1159
7.3B.2.3a.4.1	(Reserved).....	1159
7.3B.2.3a.4.2	MSD test points for intermodulation interference due to dual uplink operation for NE-DC in NR FR1 involving three bands .....	1159
7.3B.2.4	Inter-band EN-DC including FR2 .....	1159
7.3B.2.4.1	Void.....	1159
7.3B.2.5	Inter-band EN-DC including both FR1 and FR2 .....	1159
7.3B.2.5.1	Reference sensitivity exceptions due to UL harmonic interference for EN-DC including both FR1 and FR2 .....	1159
7.3B.2.3.6	Void.....	1159
7.3B.2.3.7	Lower-MSD requirements for inter-band EN-DC within FR1 .....	1159
7.3B.3	$\Delta R_{IB,c}$ , $\Delta R_{IBNC}$ for DC .....	1160
7.3B.3.0	General.....	1160
7.3B.3.1	Intra-band contiguous EN-DC .....	1160
7.3B.3.2	Intra-band non-contiguous EN-DC .....	1160
7.3B.3.3	Inter-band EN-DC within FR1 .....	1164
7.3B.3.3.1	$\Delta R_{IB,c}$ for EN-DC in two bands .....	1164
7.3B.3.3.2	$\Delta R_{IB,c}$ for EN-DC three bands .....	1167
7.3B.3.3.3	$\Delta R_{IB,c}$ for EN-DC four bands.....	1181
7.3B.3.3.4	$\Delta R_{IB,c}$ for EN-DC five bands .....	1197
7.3B.3.3.5	$\Delta R_{IB,c}$ for EN-DC six bands.....	1204
7.3B.3.3a	Inter-band NE-DC within FR1 .....	1206
7.3B.3.4	Inter-band EN-DC including FR2 .....	1206
7.3B.3.4.1	$\Delta R_{IB,c}$ for EN-DC in two bands .....	1206
7.3B.3.4.2	$\Delta R_{IB,c}$ for EN-DC three bands .....	1206
7.3B.3.4.3	$\Delta R_{IB,c}$ for EN-DC four bands .....	1206
7.3B.3.4.4	$\Delta R_{IB,c}$ for EN-DC five bands .....	1206
7.3B.3.4.5	Void.....	1207
7.3B.3.4a	(Void).....	1207
7.3B.3.5	Inter-band EN-DC including both FR1 and FR2 .....	1207
7.3B.3.5.2	$\Delta R_{IB,c}$ for EN-DC three bands .....	1207
7.3B.3.5.3	$\Delta R_{IB,c}$ for EN-DC four bands.....	1207
7.3B.3.5.4	$\Delta R_{IB,c}$ for EN-DC five bands .....	1207
7.3B.3.5.5	$\Delta R_{IB,c}$ for EN-DC six bands.....	1207
7.3E	Reference sensitivity for V2X operation in FR1 .....	1207
7.3E.1	General.....	1207
7.3E.2	Reference sensitivity for V2X .....	1207
7.3E.2.1	Intra-band contiguous V2X.....	1207
7.3E.2.2	Intra-band non-contiguous V2X.....	1207
7.3E.2.3	Inter-band V2X con-current operation .....	1207

7.3E.2.3.0	General .....	1208
7.3E.2.3.1	Reference sensitivity exception due to UL harmonic problem .....	1208
7.4	Void .....	1209
7.4A	Maximum input level for CA .....	1209
7.4B	Maximum input level for DC in FR1 .....	1209
7.4B.1	Intra-band contiguous EN-DC in FR1 .....	1209
7.4B.1a	(Void) .....	1209
7.4B.2	Intra-band non-contiguous EN-DC in FR1 .....	1209
7.4B.3	Inter-band EN-DC within FR1 .....	1210
7.4B.3a	(Void) .....	1210
7.4B.4	Inter-band EN-DC including FR2 .....	1210
7.4B.4a	(Void) .....	1210
7.4B.5	Inter-band EN-DC including both FR1 and FR2 .....	1210
7.4E	Maximum input level for V2X operation in FR1 .....	1210
7.5	Void .....	1210
7.5A	Adjacent channel selectivity for CA .....	1210
7.5B	Adjacent channel selectivity for DC in FR1 .....	1210
7.5B.1	Intra-band contiguous EN-DC in FR1 .....	1210
7.5B.1a	(Void) .....	1211
7.5B.2	Intra-band non-contiguous EN-DC in FR1 .....	1211
7.5B.3	Inter-band EN-DC within FR1 .....	1211
7.5B.3a	(Void) .....	1211
7.5B.4	Inter-band EN-DC including FR2 .....	1211
7.5B.4a	(Void) .....	1211
7.5E	Adjacent channel selectivity for V2X operation in FR1 .....	1211
7.6	Void .....	1212
7.6A	Blocking characteristics for CA .....	1212
7.6B	Blocking characteristics for DC in FR1 .....	1212
7.6B.1	General .....	1212
7.6B.2	In-band blocking for DC in FR1 .....	1212
7.6B.2.1	Intra-band contiguous EN-DC in FR1 .....	1212
7.6B.2.1a	(Void) .....	1212
7.6B.2.2	Intra-band non-contiguous EN-DC in FR1 .....	1212
7.6B.2.3	Inter-band EN-DC within FR1 .....	1212
7.6B.2.3a	(Void) .....	1212
7.6B.2.4	Inter-band EN-DC including FR2 .....	1213
7.6B.2.4a	(Void) .....	1213
7.6B.2.5	Inter-band EN-DC including both FR1 and FR2 .....	1213
7.6B.2.6	Void .....	1213
7.6B.3	Out-of-band blocking for DC in FR1 .....	1213
7.6B.3.1	Intra-band contiguous EN-DC in FR1 .....	1213
7.6B.3.1a	(Void) .....	1213
7.6B.3.2	Intra-band non-contiguous EN-DC in FR1 .....	1213
7.6B.3.3	Inter-band EN-DC within FR1 .....	1213
7.6B.3.3a	(Void) .....	1214
7.6B.3.4	Inter-band EN-DC including FR2 .....	1215
7.6B.3.4a	(Void) .....	1215
7.6B.3.5	Inter-band EN-DC including both FR1 and FR2 .....	1215
7.6B.4	Narrow band blocking for DC in FR1 .....	1215
7.6B.4.1	Intra-band contiguous EN-DC in FR1 .....	1215
7.6B.4.1a	(Void) .....	1215
7.6B.4.2	Intra-band non-contiguous EN-DC in FR1 .....	1215
7.6B.4.3	Inter-band EN-DC within FR1 .....	1215
7.6B.4.3a	(Void) .....	1215
7.6B.4.4	Inter-band EN-DC including FR2 .....	1215
7.6B.4.4a	(Void) .....	1216
7.6B.4.5	Inter-band EN-DC including both FR1 and FR2 .....	1216
7.6E	Blocking characteristics for V2X in FR1 .....	1216
7.7	Void .....	1216
7.7A	Spurious response for CA .....	1216
7.7B	Spurious response for DC in FR1 .....	1216
7.7B.1	Intra-band contiguous EN-DC in FR1 .....	1216

7.7B.1a	(Void).....	1216
7.7B.2	Intra-band non-contiguous EN-DC in FR1 .....	1216
7.7B.3	Inter-band EN-DC within FR1.....	1217
7.7B.4a	(Void).....	1217
7.7B.5	Inter-band EN-DC including both FR1 and FR2 .....	1217
7.7E	Spurious response for V2X in FR1 .....	1217
7.8	Void.....	1217
7.8A	Intermodulation characteristics for CA .....	1217
7.8B	Intermodulation characteristics for DC in FR1 .....	1217
7.8B.1	General.....	1217
7.8B.2	Wide band Intermodulation .....	1217
7.8B.2.1	Intra-band contiguous EN-DC in FR1.....	1218
7.8B.2.1a	(Void).....	1218
7.8B.2.2	Intra-band non-contiguous EN-DC in FR1 .....	1218
7.8B.2.3	Inter-band EN-DC within FR1 .....	1218
7.8B.2.3a	(Void).....	1218
7.8B.2.4	Inter-band EN-DC including FR2 .....	1218
7.8B.2.4a	(Void).....	1218
7.8B.2.5	Inter-band EN-DC including both FR1 and FR2 .....	1218
7.8E	Intermodulation characteristics for V2X operation in FR1 .....	1218
7.9	Void.....	1219
7.9A	Spurious emissions for CA.....	1219
7.9B	Spurious emissions for DC in FR1 .....	1219
7.9B.1	Intra-band contiguous EN-DC in FR1 .....	1219
7.9B.1a	(Void).....	1219
7.9B.2	Intra-band non-contiguous EN-DC in FR1 .....	1219
7.9B.3	Inter-band EN-DC within FR1.....	1219
7.9B.3a	(Void).....	1219
7.9B.4	Inter-band EN-DC including FR2.....	1219
7.9B.4a	(Void).....	1219
7.10	Void.....	1219
7.10A	Void.....	1219
7.10B	power imbalance for DC in FR1 .....	1219
7.10B.1	General.....	1219
7.10B.3	Inter-band EN-DC within FR1.....	1220

## **Annex A (normative): Measurement channels.....1222**

A.1	General .....	1222
A.2	UL reference measurement channels for E-UTRA TDD Config 2.....	1222
A.2.1	General .....	1222
A.2.2	Reference measurement channels for E-UTRA .....	1222
A.2.2.1	Full RB allocation.....	1222
A.2.2.1.1	QPSK .....	1222
A.2.2.1.2	16-QAM.....	1223
A.2.2.1.3	64-QAM.....	1223
A.2.2.1.4	256 QAM .....	1224
A.2.2.2	Partial RB allocation.....	1225
A.2.2.2.1	QPSK .....	1225
A.2.2.2.3	64-QAM.....	1228
A.2.2.2.4	256 QAM .....	1230
A.3	DL reference measurement channels for E-UTRA .....	1232
A.3.1	General .....	1232
A.3.1.1	QPSK .....	1232
A.3.1.2	64-QAM.....	1233
A.3.1.3	256-QAM.....	1234

## **Annex B: Void 1235**

## **Annex C: Void 1236**

<b>Annex D: Void</b>	<b>1237</b>
<b>Annex E: Void</b>	<b>1238</b>
<b>Annex F: Void</b>	<b>1239</b>
<b>Annex G: Void</b>	<b>1240</b>
<b>Annex H (normative):</b>	<b>Modified MPR behavior .....1241</b>
<b>Annex I (normative):</b>	<b>Dual uplink interferer .....1242</b>
<b>Annex J: Void</b>	<b>1243</b>
<b>Annex K: Void</b>	<b>1244</b>
<b>Annex L (informative):</b>	<b>Change history .....1245</b>
<b>History</b> .....	<b>1268</b>

# Sample Document

get full document from [standards.iteh.ai](https://standards.iteh.ai)

---

# 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:

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