**3GPP TSG-RAN** **WG2 Meeting #110-e R2-200xxxx**

**Electronic, June 1 – 12, 2020**

**Source: Qualcomm Incorporated**

**Title:**

**Document for: Decision**

**Agenda Item: 5.4.3**

# Introduction

This document summarizes the following email discussion.

# Discussion

## UE setting of xDD FRx split capabilities

The current procedural text in TS38.306 is as follows.

|  |
| --- |
| The UE may support different functionalities between FDD and TDD, and/or between FR1 and FR2. The UE shall indicate the UE capabilities as follows. […]  1> set all fields of UE-NR/MRDC-Capability except fdd-Add-UE-NR/MRDC-Capabilities, tdd-Add-UE-NR/MRDC-Capabilities, fr1-Add-UE-NR/MRDC-Capabilities and fr2-Add-UE-NR/MRDC-Capabilities, to include the values applicable for all duplex mode(s) and frequency range(s) that the UE supports;  1> if UE supports both FDD and TDD and if (some of) the UE capability fields have a different value for FDD and TDD  2> if for FDD, the UE supports additional functionality compared to what is indicated by the previous fields of UE-NR/MRDC-Capability:  3> include field fdd-Add-UE-NR/MRDC-Capabilities and set it to include fields reflecting the additional functionality applicable for FDD;  2> if for TDD, the UE supports additional functionality compared to what is indicated by the previous fields of UE-NR/MRDC-Capability:  3> include field tdd-Add-UE-NR/MRDC-Capabilities and set it to include fields reflecting the additional functionality applicable for TDD;  1> if UE supports both FR1 and FR2 and if (some of) the UE capability fields have a different value for FR1 and FR2:  2> if for FR1, the UE supports additional functionality compared to what is indicated by the previous fields of UE-NR/MRDC-Capability:  3> include field fr1-Add-UE-NR/MRDC-Capabilities and set it to include fields reflecting the additional functionality applicable for FR1;  2> if for FR2, the UE supports additional functionality compared to what is indicated by the previous fields of UE-NR/MRDC-Capability:  3> include field fr2-Add-UE-NR/MRDC-Capabilities and set it to include fields reflecting the additional functionality applicable for FR2; |

The following sections summarize the setting of UE capability signalling.

**Interpretation 1-a** (e.g. [R2-2002573](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2002573.zip), Qualcomm)

**Interpretation 1-b** (e.g. [R2-2003454](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003454.zip), Huawei)

**Interpretation 2** (e.g. [R2-2003269](http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003269.zip), Ericsson)

NOTE:

* “**Unable to signal**” indicates that the set of UE capabilities is allowed according to the UE capability differentiation rules in the standard, i.e. ‘yes’ or ‘no’ indications in the “FDD-TDD DIFF” and “FR1-FR2 DIFF” in TS38.306. But the UE capability signalling is not capable of expressing the set of UE capabilities
* “**Not allowed**” indicates the set of UE capabilities is NOT allowed according to the UE capability differentiation rules in the standard, i.e. ‘yes’ or ‘no’ indications in the “FDD-TDD DIFF” and “FR1-FR2 DIFF” in TS38.306.

In both cases, the UE can fallback to an allowed UE capability setting.

## UE capabilities with xDD and FRx differentiations

**Interpretation 1-a**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Support for the feature | | UE capability containers | | | | | |
| xDD-Diff in common | FRX-diff in common | fdd-Add | tdd-Add | fr1-Add | fr2-Add |
| **Case 1** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘supported | Supported | Supported | Not included | Not included | Not included | Not included |
| **Case 2** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘not supported | Not supported | Not supported | Not included | Not included | Not included | Not included |
| **Case 3** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘supported | Not supported | Supported | Not included | Supported | Not included | Not included |
| **Case 4** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘supported | Not supported | Not supported | Not included | Supported | Not included | Supported |
| **Case 5** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘not supported | Not supported | Not supported | Not included | Supported | Supported | Not included |
| **Case 6** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘supported | Unable to signal | | | | | |
| **Case 7** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘not supported | Not supported | Not supported | Supported | Not included | Supported | Not included |
| **Case 8** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘not supported | Supported | Not supported | Not included | Not included | Supported | Not included |

**Interpretation 1-b**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Support for the feature | | UE capability containers | | | | | |
| xDD-Diff in common | FRX-diff in common | fdd-Add | tdd-Add | fr1-Add | fr2-Add |
| **Case 1** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘supported | Supported | Supported | Not included | Not included | Not included | Not included |
| **Case 2** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘not supported | Not supported | Not supported | Not included | Not included | Not included | Not included |
| **Case 3** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘supported | Not supported | Not supported | Not included | Supported | Not included | Not included |
| **Case 4** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘supported | Not supported | Not supported | Not included | Supported | Not included | Supported |
| **Case 5** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘not supported | Not supported | Not supported | Not included | Supported | Supported | Not included |
| **Case 6** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘supported | Unable to signal | | | | | |
| **Case 7** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘not supported | Not supported | Not supported | Supported | Not included | Supported | Not included |
| **Case 8** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘not supported | Not supported | Not supported | Not included | Not included | Supported | Not included |

**Interpretation 2**

Label

1 UE supports the feature for the given FRX/XDD mode

0 UE does not support the feature for the given FRX/XDD

x UE does not support the given FRX/XDD mode

fdd UE includes the feature in fdd-Add-UE-NR/MRDC-Capabilities

tdd UE includes the feature in tdd-Add-UE-NR/MRDC-Capabilities

fr1 UE includes the feature in fr1-Add-UE-NR/MRDC-Capabilities

fr2 UE includes the feature in fr2-Add-UE-NR/MRDC-Capabilities

common UE includes the feature in the common branch (xDD-diff and FRx-diff) for features that do not require FR1/FR2 or FDD/TDD differentiation

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|  |  | | | |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | FR1 only | | | |  |  |  |  |  |  |
|  | FDD | TDD |  |  | FDD | TDD |  |  | FDD | TDD |
| FR1 | 1 | 0 |  | FR1 | 0 | 1 |  | FR1 | 1 | 1 |
| FR2 | x | x |  | FR2 | x | x |  | FR2 | x | x |
| fdd | | |  | tdd | | |  | common | | |
|  |  |  |  |  |  |  |  |  |  |  |
|  | FDD | TDD |  |  | FDD | TDD |  |  |  |  |
| FR1 | 1 | x |  | FR1 | x | 1 |  |  |  |  |
| FR2 | x | x |  | FR2 | x | x |  |  |  |  |
| common | | |  | common | | |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | TDD only | | | |  |  |  |  |  |  |
|  | FDD | TDD |  |  | FDD | TDD |  |  | FDD | TDD |
| FR1 | x | 1 |  | FR1 | x | x |  | FR1 | x | 1 |
| FR2 | x | 1 |  | FR2 | x | 1 |  | FR2 | x | 0 |
| common | | |  | common | | |  | fr1 | | |
|  |  |  |  |  |  |  |  |  |  |  |
|  | FDD | TDD |  |  |  |  |  |  |  |  |
| FR1 | x | 0 |  |  |  |  |  |  |  |  |
| FR2 | x | 1 |  |  |  |  |  |  |  |  |
| fr2 | | |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  | FR1+FR2 | | | |  |  |  |  |  |  |
|  | FDD | TDD |  |  | FDD | TDD |  |  | FDD | TDD |
| FR1 | 1 | 0 |  | FR1 | 0 | 1 |  | FR1 | 0 | 0 |
| FR2 | x | 0 |  | FR2 | x | 0 |  | FR2 | x | 1 |
| fdd | | |  | Unable to signal | | |  | fr2 | | |
|  |  |  |  |  |  |  |  |  |  |  |
|  | FDD | TDD |  |  | FDD | TDD |  |  | FDD | TDD |
| FR1 | 1 | 1 |  | FR1 | 0 | 1 |  | FR1 | 1 | 0 |
| FR2 | x | 0 |  | FR2 | x | 1 |  | FR2 | x | 1 |
| fr1+fdd | | |  | fr2+tdd | | |  | fr2+fdd | | |
|  |  |  |  |  |  |  |  |  |  |  |
|  | FDD | TDD |  |  | FDD | TDD |  |  | FDD | TDD |
| FR1 | 1 | 1 |  | FR1 | 1 | x |  | FR1 | 0 | x |
| FR2 | x | 1 |  | FR2 | x | 1 |  | FR2 | x | 1 |
| common | | |  | common | | |  | fr2+tdd | | |
|  |  |  |  |  |  |  |  |  |  |  |
|  | FDD | TDD |  |  |  |  |  |  |  |  |
| FR1 | 1 | x |  |  |  |  |  |  |  |  |
| FR2 | x | 0 |  |  |  |  |  |  |  |  |
| fr1+fdd | | |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

## UE capabilities with xDD differentiation only

Rapproteur’s note: It is rapporteur’s understanding that there is no difference in UE capability bit setting among different interpretations.

**Interpretation 1-a, 1-b and 2**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Support for the feature | | UE capability containers | | | | | |
| xDD-Diff in common | FRX-diff in common | fdd-Add | tdd-Add | fr1-Add | fr2-Add |
| **Case 1** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘supported | Supported | N/A | Not included | Not included | N/A | N/A |
| **Case 2** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘not supported | Not supported | N/A | Not included | Not included | N/A | N/A |
| **Case 3** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘supported | Not supported | N/A | Not included | Supported | N/A | N/A |
| **Case 4** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘supported | Not allowed | | | | | |
| **Case 5** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘not supported | Not allowed | | | | | |
| **Case 6** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘supported | Not allowed | | | | | |
| **Case 7** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘not supported | Not supported | N/A | Supported | Not included | N/A | N/A |
| **Case 8** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘not supported | Not allowed | | | | | |

## UE capabilities with FRx differentiation only

Rapproteur’s note: It is rapporteur’s understanding that there is no difference in UE capability bit setting among different interpretations.

**Interpretation 1-a, 1-b and 2**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Support for the feature | | UE capability containers | | | | | |
| xDD-Diff in common | FRX-diff in common | fdd-Add | tdd-Add | fr1-Add | fr2-Add |
| **Case 1** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘supported | N/A | Supported | N/A | N/A | Not included | Not included |
| **Case 2** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘not supported | N/A | Not supported | N/A | N/A | Not included | Not included |
| **Case 3** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘supported | Not allowed | | | | | |
| **Case 4** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘supported | N/A | Not supported | N/A | N/A | Not included | Supported |
| **Case 5** | * FR1 FDD: ‘not supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘not supported | Not allowed | | | | | |
| **Case 6** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘supported | Not allowed | | | | | |
| **Case 7** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘not supported’ * FR2 TDD: ‘not supported | Not allowed | | | | | |
| **Case 8** | * FR1 FDD: ‘supported’ * FR1 TDD: ‘supported’ * FR2 TDD: ‘not supported | N/A | Not supported | N/A | N/A | Supported | Not included |

**Proposal 1: xxxx**

# Summary

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# Conclusion

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