**3GPP TSG RAN WG1 #100bis-e R1-20xxxxx**

e-Meeting, April 20th – 30th, 2020

Source: NTT DOCOMO, INC.

Title: Summary on Email discussion [100b-e-NR-UEFeatures-MRDCCA-01]

Agenda Item: 7.2.11.10

**Document for:** **Discussion and Decision**

# **Introduction**

This contribution summarizes the following email discussion in AI 7.2.11.10 regarding UE features for MR-DC/CA.

[100b-e-NR-UEFeatures-MRDCCA-01] Email discussion/approval on feature group structure for UL power sharing for NR-DC (20th-24th April) – Hiroki (DCM)

* Discuss whether to adopt FG18-1/18-1a/18-1b or FG[18-1]/[18-1a]/[18-1b]
	+ Alt.1: Adopt FG18-1/18-1a/18-1b (i.e., remove FG[18-1]/[18-1a]/[18-1b])
		- It is clarified that FG18-1 is for both synchronous and asynchronous NR-DC scenarios
		- It is clarified that FG18-1a is for synchronous NR-DC scenario only
		- It is clarified for FG18-1b that T\_offset is only used for dynamic power sharing with look-ahead
	+ Alt.2: Adopt FG[18-1]/[18-1a]/[18-1b] (i.e., remove FG18-1/18-1a/18-1b)
		- Whether [18-1] is removed or not, and whether it should be discussed in RAN or RAN1
	+ Alt.3: Other if any

# **whether to adopt FG18-1/18-1a/18-1b or FG[18-1]/[18-1a]/[18-1b]**

In [1], FG18-1/18-1a/18-1b and alternatives ([18-1]/[18-1a]/[18-1b]) are captured as below.

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 18. MR-DC/CA enhancement | 18-1 | Basic UL power sharing for DC | Semi-static power sharing mode1 between MCG and SCG cells of same FR for NR dual connectivity. |  | Yes | N/A | Intra-frequency range DC is not supported by the UE | Per band combination | N/A | N/A |  | Absence means intra-FR DC is not supported.  | Optional with capability signalling |
| 18-1a | Semi-static UL power sharing mode 2 for DC | Semi-static power sharing mode 2 between MCG and SCG cells of same FR for NR dual connectivity. | 18-1 |  |  |  | Per band combination | N/A | N/A |  |  | Optional with capability signalling |
| 18-1b | Dynamic UL power sharing for DC | Dynamic power sharing between MCG and SCG cells of same FR for NR dual connectivity.1. Supported scenario for dynamic power sharing

T\_offset | 18-1 |  |  |  | Per band combination | N/A | N/A |  | 1) {Synch DC only, Sync and Async DC}2) {short, long} | Optional with capability signalling |
| [18-1] | Synchronous NR-DC operation | NR-DC operation with synchronization between MCG and SCGPower-sharing mode within the frequency range1. semi-static power-sharing mode 1
2. semi-static power-sharing mode 2
3. dynamic power-sharing and the value of T\_offset
 |  |  |  |  | Per band combination | N/A | N/A |  | Absence means synchronous NR-DC operation for the given band combination is not supported. 1) {Supported}2) {not supported, supported}3) {not supported, short, long} | Optional with capability signalling |
| [18-1a] | Non-SFN synchronous NR-DC operation | Operation with non-zero slot offset between MCG and SCGPower-sharing mode within the frequency range1. semi-static power-sharing mode 1
2. semi-static power-sharing mode 2
3. dynamic power-sharing and the value of T\_offset
 | 18-1 |  |  |  | Per band combination | N/A | N/A |  | Absence means non-SFN synchronous NR-DC operation for the given band combination is not supported.1) {Supported}2) {not supported, supported}3) {not supported, short, long} | Optional with capability signalling |
| [18-1b] | Asynchronous NR-DC operation | Operation with no slot alignment between MCG and SCGPower-sharing mode within the frequency range1. semi-static power-sharing mode 1
2. dynamic power-sharing and the value of T\_offset
 | 18-1 |  |  |  | Per band combination | N/A | N/A |  | Absence means asynchronous NR-DC operation for the given band combination is not supported. 1) {Supported}2) {not supported, supported}3) {not supported, short, long} | Optional with capability signalling |

Following views are provided in contributions for the RAN1#100bis-e meeting.

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| [3] | MediaTek Inc. | For the current RAN1 UE feature table of MR-DC/CA, we think the alternative 18-1/1a/1b structure marked in [ ] for intra-FR DC UL power control is more clear. Hence, we support the alternative ones.**Proposal 1: Adopt the alternative 18-1/1a/1b structure marked in [ ] for intra-FR DC UL power control in current RAN1 UE feature table.**

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| 18-1 | Synchronous NR-DC operation | NR-DC operation with synchronization between MCG and SCGPower-sharing mode within the frequency range1. semi-static power-sharing mode 1
2. semi-static power-sharing mode 2
3. dynamic power-sharing and the value of T\_offset
 |  |  |  |  | Per band combination | N/A | N/A |  | Absence means synchronous NR-DC operation for the given band combination is not supported. 1) {Supported}2) {not supported, supported}3) {not supported, short, long} | Optional with capability signalling |
| 18-1a | Non-SFN synchronous NR-DC operation | Operation with non-zero slot offset between MCG and SCGPower-sharing mode within the frequency range1. semi-static power-sharing mode 1
2. semi-static power-sharing mode 2
3. dynamic power-sharing and the value of T\_offset
 | 18-1 |  |  |  | Per band combination | N/A | N/A |  | Absence means non-SFN synchronous NR-DC operation for the given band combination is not supported.1) {Supported}2) {not supported, supported}3) {not supported, short, long} | Optional with capability signalling |
| 18-1b | Asynchronous NR-DC operation | Operation with no slot alignment between MCG and SCGPower-sharing mode within the frequency range1. semi-static power-sharing mode 1
2. dynamic power-sharing and the value of T\_offset
 | 18-1 |  |  |  | Per band combination | N/A | N/A |  | Absence means asynchronous NR-DC operation for the given band combination is not supported. 1) {Supported}2) {not supported, supported}3) {not supported, short, long} | Optional with capability signalling |

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| [4] | Intel Corporation | According to [1], two alternatives are proposed for features on power control. i.e. * Alt-1: FG 18-1/18-1a/18-1b;
* Alt-2: FG [18-1]/[18-1a]/[18-1b]

The key difference is which information is used to organize the features, the type of power control mode (Alt-1) or the type of synchronization (Alt-2). We prefer Alt-1 since it is aligned with the way to define UE features for power control for other cases, e.g. EN-DC. Based on Alt-1, further information needs to be added under 18-1/18-1a/18-1b for the behavior related to synchronization, look-ahead, etc. we provide our views below. * 18-1a: since semi-static PS mode 2 only applies to synchronized NN-DC, a clarification is needed
* 18-1b: it is not clear if T\_offset only applies to dynamic PS with look-ahead or applies to dynamic PS in general. A clarification is needed

**Proposal 1: Adopt FG18-1/18-1a/18-1b for dynamic power sharing of NN-DC** * **FG 18-1a, to clarify it is limited to synchronized NN-DC**
* **FG 18-1b: to clarify T\_offset is only used for dynamic PS with look-ahead**
 |
| [5] | Ericsson | * Proposed FGs [18-1], [18-1a], [18-1b],
	+ SFN sync between MCG and SCG is related to Rel15 parameter *sfn-SyncNRDC*. Since discussion related to this issue is ongoing in RAN (i.e., as per [2]), we propose to treat any related Rel16 discussion in RAN plenary instead of RAN1.
	+ If specifying a separate UE capability for synchronous NR-DC and asynchronous NR-DC, we propose to define ‘synchronous’ and ‘asynchronous’ according to requirements in 38.133 (i.e., NR-DC can have similar requirements as that of sync and async EN-DC currently captured in 38.133).
 |
| [6] | Nokia, Nokia Shanghai Bell | **18-1/1a/1b:** The suggested restructuring along Synchronous and Asynchronous DC does not seem necessary as the differentiation is not meaningful with all PC modes. Still it appears relevant to clarify the scenarios supported with each PC mode as follows:

|  |  |  |  |  |
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| 18-1 | Basic UL power sharing for DC | Semi-static power sharing mode1 between MCG and SCG cells of same FR for NR dual connectivity for both synchronous and asynchronous NR-DC scenarios. |  | Absence means intra-FR DC is not supported.  |
| 18-1a | Semi-static UL power sharing mode 2 for DC | Semi-static power sharing mode 2 between MCG and SCG cells of same FR for NR dual connectivity for synchronous NR-DC scenario. | 18-1 |  |
| 18-1b | Dynamic UL power sharing for DC | Dynamic power sharing between MCG and SCG cells of same FR for NR dual connectivity.1. Supported scenario for dynamic power sharing
2. T\_offset
 | 18-1 | 1) {Synch DC only, Sync and Async DC}2) {short, long} |

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| [7] | Qualcomm Incorporated | We believe the original 18-1, 18-1a, and 18-1b, should be replaced by the proposed [18-1], [18-1a], and [18-1b]. |
| [8] | Huawei, HiSilicon | The new added FG [18-1] with bracket should be removed. FG [18-1] is about Synchronous NR-DC operation, which should not be separated from FG18-1a since it is a special case of FG18-1a (non-SFN sync NR-DC), and RAN plenary decision RP-192345 mandates all Rel-16 UEs to support non-SFN sync NR-DC.***Proposal 1:*** *The new added FG 18-1 with bracket should be removed*

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|  | Samsung | OK with either approach – the non bracketed FGs will need to be differentiated between SFN/non-SFN synchronous NR-DC and asynchronous NR-DC.Synchronous/asynchronous definition is as in EN-DC. |

Based on above, following points need to be discussed for FG18-1/18-1a/18-1b.

* Whether to adopt FG18-1/18-1a/18-1b or FG[18-1]/[18-1a]/[18-1b]
	+ Alt.1: Adopt FG18-1/18-1a/18-1b (i.e., remove FG[18-1]/[18-1a]/[18-1b])
		- It is clarified that FG18-1 is for both synchronous and asynchronous NR-DC scenarios
		- It is clarified that FG18-1a is for synchronous NR-DC scenario only
		- It is clarified for FG18-1b that T\_offset is only used for dynamic power sharing with look-ahead
	+ Alt.2: Adopt FG[18-1]/[18-1a]/[18-1b] (i.e., remove FG18-1/18-1a/18-1b)
		- Whether [18-1] is removed or not, and whether it should be discussed in RAN or RAN1
	+ Alt.3: Other if any

## 2.1 Discussion

**Companies are encouraged to provide views on which alternative RAN1 should take for FG18-1/1a/1b or to propose any other alternative.**

**Alt.1: Adopt FG18-1/18-1a/18-1b (i.e., remove FG[18-1]/[18-1a]/[18-1b])**

 **Supported by:**

 **Objected by:**

**Alt.2: Adopt FG[18-1]/[18-1a]/[18-1b] (i.e., remove FG18-1/18-1a/18-1b)**

 **Supported by:**

 **Objected by:**

|  |  |
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| Company | Comment |
| ZTE | We support Alt.1We prefer to keep the original structure and adding some necessary clarification as mentioned by other companies, e.g., FG18-1a is for synchronous NR-DC scenario. Alt.1 is also in line with what we did for Rel-15 EN-DC.The non-SFN synchronous NR-DC was discussed and introduced in RAN plenary during Rel-15. If companies propose to introduce it in Rel-16, it would be better to discuss this issue in next RAN plenary. |
| Nokia, NSB | We support Alt. 1, with the additional clarification on the applicable scenarios for the components. In our view it would be enough to add that FG8-1a applies for synchronous NR-DC scenario, while FG 8-1 applies for both synchronous and asynchronous NR-DC scenarios. |
| Qualcomm | We support Alt.2. It is necessary to have separate capabilities for sync-DC and async-DC. Power-sharing should be one of the functions, which is part of sync-DC or async-DC. |
| Samsung | We see Alt. 1 and Alt. 2 as being equivalent as Alt. 1 will need to be differentiated between SFN/non-SFN synchronous DC and asynchronous DC. |
| OPPO | We prefer Alt.2. We are also ok with Alt.1 in case that power sharing for synchronous DC and asynchronous DC can be reported independently under the framework of Alt.1 |
| Intel | We prefer Alt 1 that is aligned with the structure used in other features, e.g. EN-DC. The last sub-bullet could be removed.  |
| MTK | We prefer Alt. 2 since it categorized the synchronous/asynchronous DC in a more clear way. Using Alt. 2 can save further discussions on how to differentiate the support for synchronous/asynchronous case. |
| Ericsson | We prefer Alt 1 over Alt 2 given current formulation. As stated before -- SFN sync between MCG and SCG is related to Rel15 parameter *sfn-SyncNRDC*. Since discussion related to this issue is ongoing in RAN, we think any related Rel16 discussion should be in RAN plenary instead of RAN1). Also, ‘synchronous’ and ‘asynchronous’ should follow timing requirements in 38.133. |
| Qualcomm2 | **Proposal 1:** Update the FG18-1/18-1a/18-1b as following.* Delete sync/async differentiation in FG18-1b (given the understanding that such differentiation should be done outside of this FG).
* Add “Semi-static power sharing mode 2 between MCG and SCG cells of same FR is applicable only for synchronous NR dual connectivity” in the note of FG18-1a.

**Proposal 2:** Add following descriptions in the LS document.* RAN1 lists NR-DC power-sharing features as FG18-1/1a/1b. Apart from them, RAN1 see the need of following:
	+ An optional FG that indicates support of asynchronous operation for a BC where the UE supports NR-DC operation
	+ An optional FG that indicates supported cell-grouping configurations for a BC where the UE supports NR-DC operation
		- If the UE reports a cell-grouping configuration in which MCG cell(s) and SCG cell(s) are in the same FR, the UE must support FG18-1 (FG18-1a/1b are optional).
* The capability signalling structure is up to RAN2.
* The requirements for sync-DC and async-DC are up to RAN4.

**Proposal 3:** Handling of non-SFN sync-DC is to be discussed separately. |

**FL proposal:**

* FG18-1/1a/1b are kept and FG[18-1]/[1a]/[1b] are removed.
	+ It is clarified that FG18-1a is for synchronous NR-DC scenario only

# **Conclusion**

**FL proposal:**

* FG18-1/1a/1b are kept and FG[18-1]/[1a]/[1b] are removed.
	+ It is clarified that FG18-1a is for synchronous NR-DC scenario only

TBD

# **References**

[1] R1-2001484 RAN1 UE features list for Rel-16 NR after RAN1#100-E Moderator (AT&T, NTT DOCOMO, INC.)

[2] R1-2001631 Discussion on UE feature for MR-DC CA ZTE

[3] R1-2001833 Views on Rel-16 UE features for MR-DC/CA MediaTek Inc.

[4] R1-2002024 UE feature for MR-DC Intel Corporation

[5] R1-2002426 Discussion on UE features for MR-DC Ericsson

[6] R1-2002477 On UE features for MR-DC/CA Nokia, Nokia Shanghai Bell

[7] R1-2002571 Discussion on UE features for MR-DC/CA Qualcomm Incorporated

[8] R1-2002595 Rel-16 UE features for MR-DC/CA Huawei, HiSilicon