**3GPP TSG-RAN Meeting #90e RP-20xxxx**

**Electronic Meeting, Dec 7-11, 2020**

**Agenda item:** 9.1.4

**Source:** China Unicom (Moderator)

**Title:** Summary for Email discussion on [90E][15][HP\_FDD]

**Document for:** Discussion

# Introduction

This document is a summary of the following email discussion,

*Goal: Generate an agreeable SID*

*Input contributions covered: 2284, 2285*

*Moderator: Basaier Jialade*

**Final deadline for technical comments**: 12:29h UTC 10th December

# Discussion

**RP-202284**

Title: **New SID: Study on high power UE (power class 2) for one NR FDD band**

Agenda Item: 9.1.4

For: Approval

Source: China Unicom

SI Objectives

The objectives of the SID are as follows:

1. Study the applicable scheme(s) for new power class 2 UE for one NR FDD band to comply with the SAR limits with 26dBm UE Tx power, the example band for this study is NR band n1.
2. Study interference issues (e.g. self-desense, cross device coexistence…).
3. Study the possible UE implementations, e.g. RF front-end capability, UE architectures, etc., in achieving 26dBm in FDD bands.

Companies are encouraged to provide their views on the objectives.

2.1 Initial Email Discussion

1. Comments about the objectives of the SID:

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| **Objective 1** | |
| Company Name | Comments |
| Apple | There is no duty cycle concept in FDD bands. P-MPR would limit the UE maximum output power to no more than 23 dBm to fulfill the SAR requirement. |
| LGE | It is quite different operating scenarios between PC2 for FDD+TDD DC UE and PC2 UE in a single carrier NR FDD band.  In PC2 DC UE, the max power is 23dBm for FDD LTE band, but the max output power in FDD NR band is 26dBm in this WID. So need to study the SAR regulatory requirements where 26dBm power class in FDD bands is allowed. |
| Qualcomm | This objective could be ok, however, based on the discussions so far, it seems difficult to conclude on any schemes given there could be multiple. |
| Intel | Objective is generally ok.  Overall, we observe a very big amount of HPUE work items which may have an overlapping scope in terms of applicable schemes. So, there is a big risk that different solutions are used for different scenarios which would overcomplicate UE implementations. Also, some unification of the schemes is recommended to avoid duplicated work. |

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| **Objective 2** | |
| Company Name | Comments |
| Apple | In addition to SAR issue, the duplexer power handling capability also needs to be considered. Redesign of duplexer may be needed to handle higher transmission power and provide better isolation to Rx band to prevent further REFSENS degradation. |
| LGE | Firstly, RAN4 need to study the coexistence evaluation to protect legacy system with max. output power. Based on the coexistence evaluation results, RAN4 need to discuss the detail RF requirements for PC2 UE in FDD band not only the self-desense but also detail Tx requirements such as MPR/A-MPR and so on. |
| Qualcomm | This objective is too generic, it has to clarified and fine tuned. What kind of co-existence study is sought? Is this also about having a adjacent channel co-existence study? |
| Intel | The objective is quite generic and more details should be provided |
| Skyworks | We agree with Apple that duplexer power handling is an issue that requires attention. Note that this is sensitive to both peak power and average power (thermal which in turns creates wider frequency shift in the filters). REFSENS will need reevaluation for self desense but also some band protection and AMPR/NS |

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| **Objective 3** | |
| Company Name | Comments |
| T-Mobile USA | We have a fundamental question about the motivation for this WI. With TDD the duty cycle is limited to less than 100%, so it is obvious that there is benefit for transmitting higher power, and SAR requirements can be met due to the duty cycle. With FDD it is not clear why there would be a benefit for PC2. For instance, if UE 1 is assigned 1 PRB with 100% duty cycle and is limited to PC3, and UE 2 is assigned 2 PRBs with 50% duty cycle and can transmit at PC2, the PSD would be the same in both cases, so the throughput should be the same. We know there were simulation results in the motivation paper, but we’d like to understand the theoretical benefit, especially given the workload in RAN4. It would be helpful if we could have an explanation of why there should be improvement with PC2 with 50% duty cycle vs. PC3 with 100% duty cycle. Intuitively it seems like an even trade. |
| Apple | The SAR issue needs to be resolved first before we can discuss the possible UE implementation.  We also have the same question as raised by T-Mobile USA on why the PC2 throughput would be better between the two operation scenarios as exemplified. |
| LGE | For, Objective1, LGE would like to capture study on the detail SAR regulation requirements based on the regional regulatory in countries where 26dBm power class in FDD bands is allowed.  Also we need to clarify how to resolve the SAR issues with max. 26dBm Tx power in FDD bands. Only possible way might be to restrict duty-cycle in FDD bands. It is not clear what is beneficial point for system operating perspective. |
| Qualcomm | This objective should also discuss the feasibility of building components that can handle higher power and their impact on device implementation. |

2. Are there any other objectives to be added to the SID?

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| Company Name | Comments |
| Qualcomm | We believe that first the system level gains from this feature should be understood. The proponent has shown some gains, however, it is not clear which aspects were taken into account. For example, was the impact of added Tx noise taken into account? How is the rise over thermal due to increase UL power modeled/quantified? This could lead to some REFSENS degradation. If there is a study on this feature, the first step should be system study to evaluate the gains. |
| Intel | Agree with Qualcomm and T-Mobile USA that system level gains should be clarified. For instance, the results show big gains for cell center UEs which may not necessarily use full TX power. The baseline assumptions on UL Duty cycle for PC3 and PC2 in the system level simulations are unclear. Is 50% or 100% UL duty cycle assumed for PC3? |

3. The target completion date is RAN#93 (3 quarters), any comments on the timeline?

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| Company Name | Comments |
| Qualcomm | It seems very difficult to complete such a study in just 3 meetings given that some system level study is also needed. Even if the study was just on how to implement such a UE, we believe it is very unlikely that conclusions can be reached in just 3 quarters. |

# Summary and final proposal