**3GPP TSG RAN WG1 #101 R1-200xxxx**

**e-Meeting, May 25th – June 5th, 2020**

Agenda Item: 6.2.1.1

Source: Moderator (Qualcomm Incorporated)

Title: FL summary of email discussion [101-e-LTE-eMTC5-WUS-01]

Document for: Discussion and Decision

# 1 Introduction

This email discussion followed the preparatory email discussion [101-e-Prep-LTE-eMTC5-GroupWUS] which is summarized in [1]. This document summarizes the following email discussion:

[101-e-LTE-eMTC5-WUS-01] Email discussion on the alignment of WUS resource locations between RAN1 agreement and RAN2 specification by 5/29 – Le (Qualcomm)

* Discus whether to send LS to RAN2, clarifying the intention behind the agreement for frequency allocation below and above center frequency and asking RAN2 to implement the intended functionality as suggested in TP2.2 of [R1-2004684](https://protect2.fireeye.com/url?k=a796f407-fa58f5b3-a7977f48-000babdfecba-d70b87001ed72dd3&q=1&u=https%3A%2F%2Fwww.3gpp.org%2Fftp%2Ftsg_ran%2FWG1_RL1%2FTSGR1_101-e%2FInbox%2FR1-2004684.zip).

# 2 Alignment of WUS resource locations between RAN1 agreement and RAN2 specification

In RAN1#99, the defined WUS resource locations has been agreed as

**Agreement**

For WUS resources with up to 2-FDM and up to 2-TDM, define the WUS resource ID mapping order as WUS resource ID 0, 1 in same time location and 0, 2 in same freq location

|  |  |  |  |
| --- | --- | --- | --- |
| freqLocation of WUS resource 0 | n0 | n2 | n4 |
| WUS resource locations  |

|  |  |  |  |
| --- | --- | --- | --- |
| *f* |  2 | 0 |  |
|  | 3 | 1 |  |
|  |  |  | *t* |

 | Alt1:

|  |  |  |  |
| --- | --- | --- | --- |
| *f* |  3 | 1 |  |
|  | 2 | 0 |  |
|  |  |  | *t* |

Alt2:

|  |  |  |  |
| --- | --- | --- | --- |
| *f* |  |  |  |
|  | 2 | 0 |  |
|  | 3 | 1 | *t* |

Alt1 if NB is below center carrier; otherwise Alt2. |

|  |  |  |  |
| --- | --- | --- | --- |
| *f* |  |  |  |
|  | 3 | 1 |  |
|  | 2 | 0 | *t* |

 |

RAN1’s intention that WUS resources are allocated on PRBs towards the center of the carrier and not towards the edge of the carrier since that would increase strain on spectrum mask requirements. However, in the Table 7.5.x-1 of the most recent CR [2] of TS 36.304 (shown below with the affected elements highlighted) does not reflect the intended functionality.

**Table 7.5.x-1: WUS Resource frequency location**

|  |  |
| --- | --- |
| ***WUS Resource******(***$N\_{ID}^{resource}$***)*** | ***Frequency location of WUS Resource ID 0*** |
| ***n0*** | ***n2*** | ***n4 (Note 1)*** |
| ***NB below centre frequency*** | ***NB above centre frequency*** |
| WUS Resource 1 | n2 | n0 | n4 | n2 |
| WUS Resource 2 | n0 | n2 | n2 | n4 |
| WUS Resource 2(Note 2) | n4 | n4 | n0 | n0 |
| WUS Resource 3 | n2 | n0 | n4 | n2 |
| Note 1: This column is applicable if wus-Config is present.Note 2: This row is applicable for the resource pattern ID 7Editor Note : It is FFS whether further updates needed for WUS Resource ID 0 =n2. |

In order to capture the intended functionality in the specification, the content of the two columns can simply be interchanged such that below-center narrowbands use WUS frequency locations n2 and n4 whereas above-center narrowbands use WUS frequency locations n0 and n2 [3].

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| <TP2.2 for Table 7.5.x-1 of TS 36.304>Table 7.5.x-1: WUS Resource frequency location

|  |  |
| --- | --- |
| ***WUS Resource******(***$N\_{ID}^{resource}$***)*** | ***Frequency location of WUS Resource ID 0*** |
| ***n0*** | ***n2*** | ***n4 (Note 1)*** |
| ***NB below centre frequency*** | ***NB above centre frequency*** |
| WUS Resource 1 | n2 | n4 | n0 | n2 |
| WUS Resource 2 | n0 | n2 | n2 | n4 |
| WUS Resource 2(Note 2) | n4 | n0 | n4 | n0 |
| WUS Resource 3 | n2 | n4 | n0 | n2 |
| Note 1: This column is applicable if wus-Config is present.Note 2: This row is applicable for the resource pattern ID 7Editor Note : It is FFS whether further updates needed for WUS Resource ID 0 =n2. |

 |

**Proposal 1:** **Send LS to RAN2, clarifying the intention behind the agreement for frequency allocation below and above center frequency and asking RAN2 to implement the intended functionality as suggested in TP2.2.**

|  |  |
| --- | --- |
| **Company** | **Comments on Proposal 1** |
| Ericsson | We support the Feature Lead’s Proposal 1. |
| Qualcomm | We agree to clarify the intention behind the RAN1 agreement.In the RAN1 agreement, n0, n2, n4 of WUS resource 0 location is defined from up to down. However, the ‘NB below/above centre frequency’ for Atl1/2 selection is not clear.If WUS resource 0 is in n2, the intention is to use* Alt1 if NB DC is **higher** than centre frequency (so that the WUS resource in the PRB pair n4, n5 is not used)
* Alt2 if NB DC is **lower** than centre frequency (so that the WUS resource in the PRB pair n0, n1 is not used)

Therefore, it may be more accurate to say ‘NB higher/lower than centre frequency’ in Table 7.5.x-1. **Table 7.5.x-1: WUS Resource frequency location**

|  |  |
| --- | --- |
| ***WUS Resource******(***$N\_{ID}^{resource}$***)*** | ***Frequency location of WUS Resource ID 0*** |
| ***n0*** | ***n2*** | ***n4 (Note 1)*** |
| ***NB higher than centre frequency*** | ***NB lower than centre frequency*** |
| WUS Resource 1 | n2 | n0 | n4 | n2 |
| WUS Resource 2 | n0 | n2 | n2 | n4 |
| WUS Resource 2(Note 2) | n4 | n4 | n0 | n0 |
| WUS Resource 3 | n2 | n0 | n4 | n2 |

 |
| Huawei/HiSilicon | Our understanding of the RAN1 agreement is illustrated below, assuming the vertical axis refers to frequency, and the horizontal axis refers to time.So it seems the current 36304 is correct, or we miss something? Or the definition of “n0/n2/n4” is different when NB is above or below center carrier?

|  |  |
| --- | --- |
| Empty: n0 | Empty: n0 |
| 2: n2 | 0: n2 |
| 3: n4 | 1: n4 |

( NB is above center carrier, Alt 2 will be chosen)--------------------center carrier--------------------(NB is below center carrier, Alt 1 will be chosen)

|  |  |
| --- | --- |
| 3: n0 | 1: n0 |
| 2: n2 | 0: n2 |
| Empty: n4 | Empty: n4 |

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|  |  |
|  |  |

# References

R1-2002512

1. [R1-2004684](https://protect2.fireeye.com/url?k=a796f407-fa58f5b3-a7977f48-000babdfecba-d70b87001ed72dd3&q=1&u=https%3A%2F%2Fwww.3gpp.org%2Fftp%2Ftsg_ran%2FWG1_RL1%2FTSGR1_101-e%2FInbox%2FR1-2004684.zip), “Feature Lead Summary of Maintenance for group MWUS,” Moderator (Qualcomm Incorporated), RAN1 #101-e, May 2020.

1. [R2-2003920](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003920.zip), “Corrections to WUS group for eMTC,” Nokia, RAN2 #109bis, April 2020.
2. [R1-2004654](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004654.zip), “Corrections for UE-group wake-up signal for LTE-MTC,” Ericsson, RAN1 #101-e, May 2020