TSG-RAN Working Group 1, AH 21 **TSGR1(00)0832**

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Agenda Item: AH21
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To: TSG RAN WG1
Title: Options for the operator to increase the cell range beyond 10 km for the low chip rate TDD option
Document for: Discussion and Approval

Introduction

According to the present 3GPP discussions 10 km is considered to be the max. cell radius for the low chip rate TDD option. This contribution identifies options for the operator to increase the cell rage beyond that value.

Conclusion

It's proposed to discuss and include the following text proposal into the clause 4.3.1 of Training sequences for spread bursts TR25.928.

---------- changes to TR25.928 begin ----------

4.3.1 Deployment scenarios

[Description:]

For the low chip rate TDD option, the deployment should be flexible for all the scenarios like macro cell, micro cell and pico cell, etc. and also should provide the fixed wireless access.

Dependent on the kind of interference accepted by the operator, the operator can vary the max. cell radius in a trade-off with UL - DL interference with the following limitations:

Table 1 Interference scenarios and the corresponding max. cell radius

Case	Max. cell radius
no UpPTS – DwPTS interference allowed	11.25 km
UpPTS – DwPTS interference allowed, but no interference to TS0 allowed	22.5 km
no TS1 – DwPTS interference allowed, other interference allowed	30 km
TS1 – DwPTS interference allowed, but no interference to TS0 allowed	41.25 km

[Rational:]

The guard period of 75 μs between the DwPTS and the UpPTS is designed to avoid interference between the UpPTS (UL) and the DwPTS (DL). Therefore the cell size ensuring the interference free reception of the DwPTS is guaranteed to a size of approximately 10 km in radius (exact value 11.25 km).

Consequently, for bigger cell radii there is a conflict that the advanced UpPTS interfering the DwPTS reception of another UE being close by.

Even though the UpPTS – DwPTS interference is possible for bigger cell radii then 11.25 km, the impact on the quality of service can be low and acceptable for an operator willing to operate bigger cells.

There are three reasons for that:

1. The probability that the a UE is close to another UE is low - especially for big cells
2. The DwPTS needs not to be received by every mobile in every frame. A few DwPTSs being not received during initial cell search mean no big degradation.
3. The UpPTS is not transmitted every frame it is only needed for random access or handover. So the probability of disturbance is rather low.

It is recommended that the operator avoids interference of TS1 to TS0 by means of the choice of the cell radius. This interference would mean permanent interference for TS0.

The operators can judge the trade-off between quality of service and range and select the range accordingly.

The maximum cell radius d_{max} is dependent on the time t_{gap} between the potentially interfering UL signal and the potentially interfered DL signal by to following equation:

$d_{\max} = \frac{c\, t_{gap}}{2}$; c is velocity of light.

The following table shows the possible trade-offs between cell radius and interference:

Figure 1 Allowed cell radius for the occurrence of the special UL - DL interference

Potentially interfering UL signal	Potentially interfered DL signal	t_{gap} in μs	d_{max} in km
UpPTS	DwPTS	75	11.25
UpPTS	TS0	150	22.5
TS1	DwPTS	200	30
TS1	TS0	275	41.25

[Explanation difference:]

For the high chip rate option there is no DwPTS – guard – UpPTS structure. Here, the UL time slots are following the DL time slots immediately. Thus, there is only one step in degree and quality of interference between DL and UL signals.

For the low chip rate option, it makes a difference in quality and degree whether the DwPTS or TS is interfered by the UpPTS or TS1. Hence the trade-off between cell range and interference is more manifold for the low chip rate option.

---------- changes to TR25.928 end ----------