Spectrum sharing in infrastructure based Cognitive Radio networks

Igor Strykhalyuk[1], Taras Maksymyuk[2],
[1] RAS Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12,
E-mail: strykhalyuk@gmail.com.
[2] TC Department, Lviv Polytechnic National University, UKRAINE, Lviv, S. Bandery street 12,
E-mail: taras.maksymyuk@gmail.com.

Abstract **– The technique of cognitive radio network deployment in existing licensed spectrum was presented. Proposed method provide the radio resources utilization improving.**

Keywords **– Cognitive Radio, GSM, LTE, Radio Resources.**

I. Introduction

Modern researches in field of mobile network may be divided in dependence of network infrastructure in a specific region. Nowadays, the most actual issue now is reforming of the existing frequency range for LTE deployment. Nowadays, the most common band - 900/1800 MHz, which in usual licensed for the GSM networks. The main disadvantage of infrastructure-based CRn is that they allows to allocate LTE channels in one of the discrete frequency bands.

In order to allocate frequency resources required for LTE, is necessary to sensing the available frequency channels and make them reforming to ensure the free spectrum as wide as possible. The new techiques of CRn spectral efficiency increasing allows to minimize spectrum which uses for LTE technology [1].

II. Method of Spectrum Sharing Between GSM and LTE

Consider the GSM radio interface [2]. The spectrum is divided into 124 channels in the 900 MHz range, and into 384 channels in the 1800 MHz range. Each channel has a bandwidth of 200 kHz. Channel transmit TDMA frame which consists of 8 time channels in 577 ms each. At one time the channel transmit voice information per user. Thus, in a 200 kHz band 8 subscribers can simultaneously carry out the transmission.

LTE uses following physical parameters:

- subcarrier spacing: 15 kHz;
- OFDM symbol duration: 66.667 microseconds;

The smallest unit on each subcarrier is a single transmission step on one subcarrier with a length of 66.667 microseconds, called Resource Element [3]. The smallest transmission unit that can be scheduled for each user is Resource Block. Resource Block consist of 12 subcarriers and 7 time intevarls. Thus the total bandwidth and duration of Resource Block is 180 kHz and 0.5 respectively. Note that:

$$\Delta F_{RB} < \Delta F_{GSM}, T_{RB} < T_{GSM}, \quad (1)$$

where ΔF_{GSM}, T_{GSM} – bandwidth and duration of GSM physical channel.

Thus we can transfer data of LTE user in GSM physical channel. Furthermore we ensure guard bands by 10 kHz on either side of frequency channel for reducing the interference from neighboring channels. In addition we have 77 us for guard interval between neighboring channels in TDMA frame. Figure 1 shows the conception of this method.

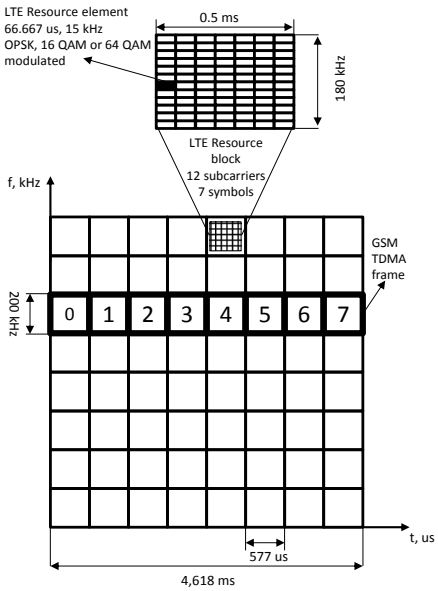

Fig.1. Transmission of LTE Resource Block by GSM physical channel in TDMA frame

III. Conclusion

Proposed method can be efficiently implemented in state-of-the-art mobile networks. The advantage of our technique implementation is more flexible radio interface. If LTE subscriber request only voice channel we can schedule the one GSM physical channel for him, and it is not necessary to define more resources. Thus solve the actual problem of joint spectrum utilization between GSM and LTE.

References

[1] Стрихалюк І. Б. Теоретико-ігрова модель розподілу канальних ресурсів у інформаційній когнітивній радіосистемі/ І. Б. Стрихалюк // матеріали 9-ої міжнародної НТК «Сучасні проблеми радіотехніки та телекомунікацій». – Севастополь. – 2013. – С. 98.

[2] M. Jo, T. Maksymyuk, M. Kyryk and L. Han, “Cognitive Radio Approach for LTE Deployment”. In Proc. IEEE International Conference on The IXth International Conference Perspective Technologies and Methods in MEMS Design (MEMSTECH 2013), p.63-64, Apr. 2013.