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Kyrgyz Republic

DEVELOPMENT OF MODERN TELECOMMUNICATIONS AND PROBLEMS OF STATE REGULATION OF TELECOMMUNICATIONS IN NEW COUNTRIES

Our original document demonstrates the importance of creating systems for spectrum management and monitoring in new and developing countries in order to develop telecommunications as a whole, and at the same time of reducing the risks associated with running such systems on credit.

By way of example, this addendum considers one of the approaches to loan repayment when the loan is given to the regulatory agency of the country for the creation and development of a radio spectrum management and control system. In this approach we make use of the recommendations contained in Report ITU-R SM.2012 entitled "Economic aspects of spectrum management", which was submitted to the ITU Radiocommunication Assembly in 1997.

Depending on the loan conditions, the total credit can be divided into parts, which the national regulatory agency responsible for the spectrum should collect annually from the radiocommunication operators and other spectrum users. These annual fees go towards its overall yearly expenditure on spectrum management and monitoring, staff salaries, amortization of buildings, electricity, etc. These annual costs can be summarized and expressed as:

$$C_{ann} = C_{cr} + C_{oth} \quad (1)$$

where:

C_{ann} is the total annual cost of radio spectrum management and monitoring,

C_{cr} is the share of resources that has to be collected in a given year to service the credit,

C_{oth} is all other expenditure on spectrum management and monitoring.

The C_{ann} amount is to be raised by means of an annual operating fee paid by the operators on a fair and non-discriminatory basis. The payment should depend on the amount of bandwidth used and the

area of the territory covered by the radio equipment of particular users, which will encourage them to make effective use of the radio frequency resource.

For this purpose, as indicated in a series of recommendations, we can make use of a three-dimensional value to define the radio frequency resource, as follows:

$$Z = F \cdot S \cdot t$$

where:

Z is the radio frequency resource used,

F is the radio frequency band used,

S is the area of the territory used,

t is the time.

To determine the value of the annual fees, it is necessary to determine the value of the radio frequency resource used, then to determine the value of the payment per unit of the radio frequency resource, after which each user will pay according to the value of the radio frequency resource used by him.

The annual fee may be determined as follows:

1 Since payment for the spectrum is made once a year, the time t for all users can be taken to be identical and equal to one year.

2 The common territory used by all users of the radio frequency spectrum can be designated S_{com} and defined as the area of the territory of the Republic on which the major part of the population lives.

As the distribution of the population is not uniform, the entire territory of the Republic is divided into (m) territories and a coefficient Bj is introduced to take account of the density of the population, enabling us to make the annual payment equitable for the different users of the radio frequency spectrum, given that the costs of technical monitoring rise with an increase in population density, with the highest expenditure in heavily populated cities.

Thus the overall physical space will be determined by the formula:

$$Scom = \sum_{j=1}^{m} Sj;\ Sj = Bj \cdot lj \qquad (2)$$

where:

Sj is the theoretical area of the j-th territory of the Kyrgyz Republic,

Bj is the coefficient reflecting the density of population of particular areas of the Republic in accordance with Table 1,

λj is the actual area of the j-th territory of the Republic,

m is the overall number of territories into which the Kyrgyz Republic is divided in accordance with Table 1.

3 Depending on the assignment of a particular portion of the spectrum, it will be necessary to monitor a different number of signal parameters and characteristics, since a different number of radio facilities for a given usage may be located on the same territory. Furthermore, the use of a given portion of the spectrum may have a different commercial value for the user, and monitoring is

much more complicated in urban areas. All this leads to a differentiation in the various frequency bands and the introduction of the concept of a theoretical frequency band used:

$$Fi = \alpha i \cdot \Delta fi \qquad (3)$$

where:

Fi is the theoretical frequency band used,

αi is the coefficient depending on the type of activity and conditions of use of the frequency bands,

Δfi is the actual frequency band used.

TABLE 1

Table taking account of the density of population in various territories of the Kyrgyz Republic

No.	Designation	Bj
	Province	
	Naryn	1
	Talas	2.7
	Issyk-Kul	3.5
	Jalal-Abad	5.6
	Osh	5
	Chuy	8
	Cities and settlements of an urban type	
	With a population of 10 000 to 50 000 inhabitants	16
	With a population of 50 000 to 100 000 inhabitants	32
	With a population of 100 000 to 500 000 inhabitants	64
	With a population over 500 000 inhabitants	128

TABLE 2

Table of coefficients taking account of the complexity of monitoring and commercial value of the portions of the radio frequency spectrum used

No.	Type of activity using the spectrum	ai
	Government communication	1
	Television (city)	10
	Television (village)	1
	Radio (city)	20
	Radio (village)	2
	Cellular (city)	48
	Cellular (village)	16
	Trunk (city)	48
	Trunk (village)	16
	Paging (city)	144
	Paging (village)	48
	Radio-relay (city)	24
	Radio-relay (village)	8
	Satellite (city)	24
	Satellite (village)	8
	Other types of mobile communication (city)	15
	Other types of mobile communication (village)	5

4 The theoretical radio frequency resource Zk, used for a specific frequency assignment (or for an allocation for a particular type of use) is determined in accordance with equations (2) and (3), as follows:

$$Zk = (\alpha i \cdot \Delta fk) \times (Bj \cdot \Delta Sk) \qquad (4)$$

where

Δfk is the actual frequency band used for a given (k-th) frequency assignment,

Bj and αi are determined in accordance with Tables 1 and 2,

ΔSk is the actual area of the territory used for a given (k-th) frequency assignment, ΔSk representing the case-specific **area of the coordination area (territory)** on which the radio equipment of a particular user operates in a given frequency band, while other users cannot use this band.

The overall theoretical radio frequency resource used throughout the year on the territory of the Kyrgyz Republic is determined as follows:

$$Z = L \cdot \sum_{k=1}^{n} Zk \qquad (5)$$

where:

Zk is determined according to equation (4),

n is the overall number of frequency assignments,

L is the estimated expansion coefficient for the theoretical radio frequency resource used.

5 We can now determine the cost of the technical monitoring per unit of the radio frequency resource. This cost will be determined as the relationship of the annual expenditure of the regulatory

agency on technical radio monitoring C_{ann} to the theoretical total radio frequency resource Z used on the territory of the Kyrgyz Republic.

Accordingly, if we take the product (1 kHz · 1 km^2 · 1 year) as the theoretical unit of the radio frequency resource, the annual cost per such unit can be determined as follows:

$$\Delta C_{ann} = \frac{C_{ann}}{Z} \qquad (6)$$

6 The annual payment by users of the radio frequency resource: the amount determined by use of equation (6) can be taken as the annual payment per unit of the radio frequency resource.

Hence the total annual fees Cf of a **specific user** for a specific (k-th) private assignment will be determined by the formula:

$$Cf = \Delta C_{ann} \cdot Zk \qquad (7)$$

where:

Zk is determined by equation (4).

Conclusion

This method of collecting annual fees for the use of a radio frequency resource is one example of the application of economic levers for radio spectrum management.

In this instance, the annual fees paid by a particular user reflect the frequency band and area of territory used by him, the market value of the spectrum used, the profitability of the location of his radio equipment, and the actual volume of the radio frequency resource used in the country. At the same time, by varying the value of the coefficients, it is possible to promote the use of particular ranges of the radio frequency spectrum, particular areas of the country or particular types of telecommunication services.

Furthermore, the income that may be expected from this method offers the possibility of a return on the resources invested in the system for managing and monitoring the radio frequency spectrum and may provide a basis for obtaining credit for the creation and development of such a system, which will have great significance for the overall development of telecommunications in the country.