



Guidelines for the Review of Spectrum Pricing Methodologies and the preparation of Spectrum Fees Schedules

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Introduction to the Guidelines

- This presentation provides an introduction and overview to the Spectrum Price Methodology and Fee Schedule Guidelines which provide regulators and radio spectrum users with a better understanding of the purpose, objectives, principles, methods and strategies connected with deterring spectrum prices and preparing spectrum fee schedules.
- As well, the guidelines contrast the advantages and disadvantages of various spectrum price methods in achieving the primary goals modern spectrum management - ensuring that radio frequencies are used efficiently – both technically and economically.

Guideline Contents

- Spectrum Price Principles and Objectives
- Determining Spectrum Prices – Administrative and Market-based Mechanisms
- Issues with Setting Spectrum Prices
- Closer Look at Spectrum Price Methodologies
- Preparing Administrative Spectrum Fee Schedules
- Examples of Administered Price Method – Spectrum Fee Schedule

Spectrum Prices Linkages

- ▶ Spectrum prices and establishment spectrum fees are closely linked to economic and market conditions, technical factors such as which technologies and services are being used or deployed and the efficiency and quality of those technologies and services, and how spectrum is assigned to spectrum users.



Spectrum Price Principles

- ▶ Spectrum allocated to the highest value use or uses to ensure maximum benefits to society are realized;
- ▶ Mechanisms in place to enable and encourage spectrum moving to its highest value use;
- ▶ Greater access to spectrum facilitated by least cost and least restrictive spectrum management approaches;
- ▶ To the extent possible, regulators and spectrum managers need to promote both regulatory certainty and flexibility in how spectrum is used;
- ▶ Balance should be achieved between the cost of interference and the benefits obtainable from greater spectrum utilization;
- ▶ Fees based on objective factors and all licence holders in a given frequency band should be treated on an equitable basis.
- ▶ Fees calculated in a clear way with consultation with stakeholders and published;
- ▶ Simple to administer and balanced against efficient spectrum use if fees are set taking account of parameters such as bandwidth, frequency band or coverage.

Spectrum Price Principles – cont'd

- ▶ Spectrum fees should be reviewed at suitable intervals in order to cater for changes in economic KPIs or advancement in technologies resulting in increase in demand of a particular band;
- ▶ Mechanisms should be in place to avoid, detect and where necessary prevent spectrum hoarding which will deter competition;
- ▶ Establish a balance between financial approach and other key facets - regulatory (competition), social (universal service).

Spectrum Price Objectives

- ▶ Spectrum prices should *promote the efficient use of spectrum*. As a vital natural resource, the price of spectrum should be sufficient enough to ensure that it is valued and used wisely. Use of the spectrum provides considerable benefit to the economy and the benefit derived from spectrum should be maximized;
- ▶ The costs associated with managing and regulating radio frequencies (including monitor and control) should be *recovered from those who benefit from spectrum management activities*. User pay should apply to all users of spectrum – both public and private;
- ▶ Finally, important social and cultural objectives can be advanced by use of the spectrum and *spectrum pricing should facilitate the achievement of government social and cultural objectives*.

Administered and Market-based Methods

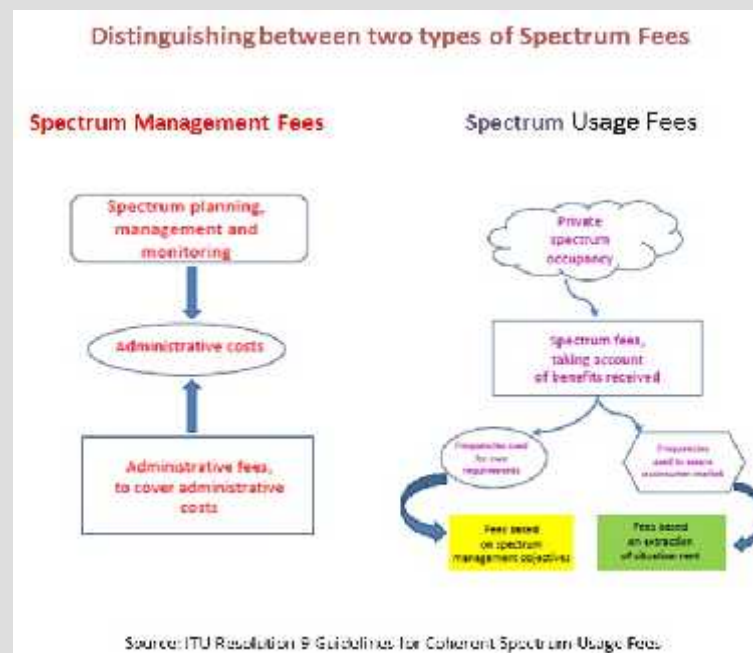
- ▶ Spectrum prices for radio frequencies are established using either an administrative method, a market-based method, or by using a combination of both administrative and market-based mechanisms.
- ▶ **Administrative** mechanisms include administrative incentive pricing (AIP) and spectrum fee formulas that recover the Regulator's cost of spectrum management (cost-based).
- ▶ **Market-based** mechanisms for setting spectrum prices typically involve a market exchange such as spectrum auctions and (in the secondary market) spectrum trading.

Issues with Setting Spectrum Fees

- ▶ Spectrum Managers need to review and consider various issues when deciding upon the method, the financial basis and amounts and the timing for payment of fees in respect of a particular spectrum band, type of use or type of user. These issues include:
 - ▶ Fiscal context;
 - ▶ The particular relevant principles and objectives for certain types of spectrum fees;
 - ▶ Funding the regulators' operations;
 - ▶ The demand and supply for the spectrum;
 - ▶ Technological change;
 - ▶ Type and duration of the spectrum authorization and renewal options.

Closer Look at Spectrum Price Methodologies

- ▶ Administrative and market-based methods such as auctions and AIP are reviewed in Section 5 of the Guidelines.
- ▶ The administrative assignment of spectrum usually includes the imposition of spectrum management fees and spectrum usage fees. These fees can take the form of simple charges or more complex formulae. The two types of fees are described below and further illustrated below:



Closer Look at Spectrum Price Methodologies

- ▶ Spectrum management fees related to cost recovery of associated spectrum management expenditures include direct and indirect costs:
 - ▶ Salaries for skilled professional (including monitoring and enforcement) and administrative spectrum management staff;
 - ▶ Investments in ICT's and databases including: spectrum management tools, national frequency allocation tables, spectrum users databases and monitoring system and equipment such as fixed and mobile monitoring stations and their upgrades/calibrations;
 - ▶ Capex and Opex for automated spectrum management functions and their upgrades;
 - ▶ Office space and services for utilities;
 - ▶ Research activities and costs associated with consultations and publications;
 - ▶ Interference coordination/mitigation activities;
 - ▶ Participation in ITU and other international meetings;
 - ▶ Management overheads;
 - ▶ Legal fees for enforcement actions;
 - ▶ Refarming
- ▶ Some costs will be common to a band or to a radio service as in the case of a particular band planning (700 MHz Band Plan); whereas others will be common to a group of bands and some, such as management overheads, will straddle all services and authorisations

Spectrum Fees – Simplified Formula

- ▶ The simplest general formula for setting administrative spectrum fees to recover costs using a simple model of direct and indirect costs appears below:

$$\text{Spectrum Fee} = \frac{\text{Spectrum Management Costs (Direct and Indirect)}}{\text{Amount of Spectrum Assigned to the User}}$$

Spectrum Fees – Universal System Performance Pricing Model

- ▶ A spectrum price formulated from a number of separate elements based on any or all of various criteria such as the amount of spectrum used, number of channels or links used degree of congestion, efficiency of radio equipment, transmitter power/coverage area, geographical location and so forth.

$$P = \frac{V}{M} \times \frac{K_f K_s}{K_m} \times C_s \times K_p$$

- ▶ Where -

- ▶ P = the spectrum price
- ▶ V = volume of space or geometric area occupied
- ▶ M = useable results obtained from the radio equipment considered, for example the number of channels to be provided or users to be served
- ▶ K_f = coefficient reflecting specific characteristics of range used
- ▶ K_s = coefficient taking into account the region/location of the radio station installation
- ▶ K_m = coefficient reflecting the social benefit of radio system
- ▶ C_s = annual spectrum management costs
- ▶ K_p = coefficient reflecting the level of spectrum access demand in the band in question

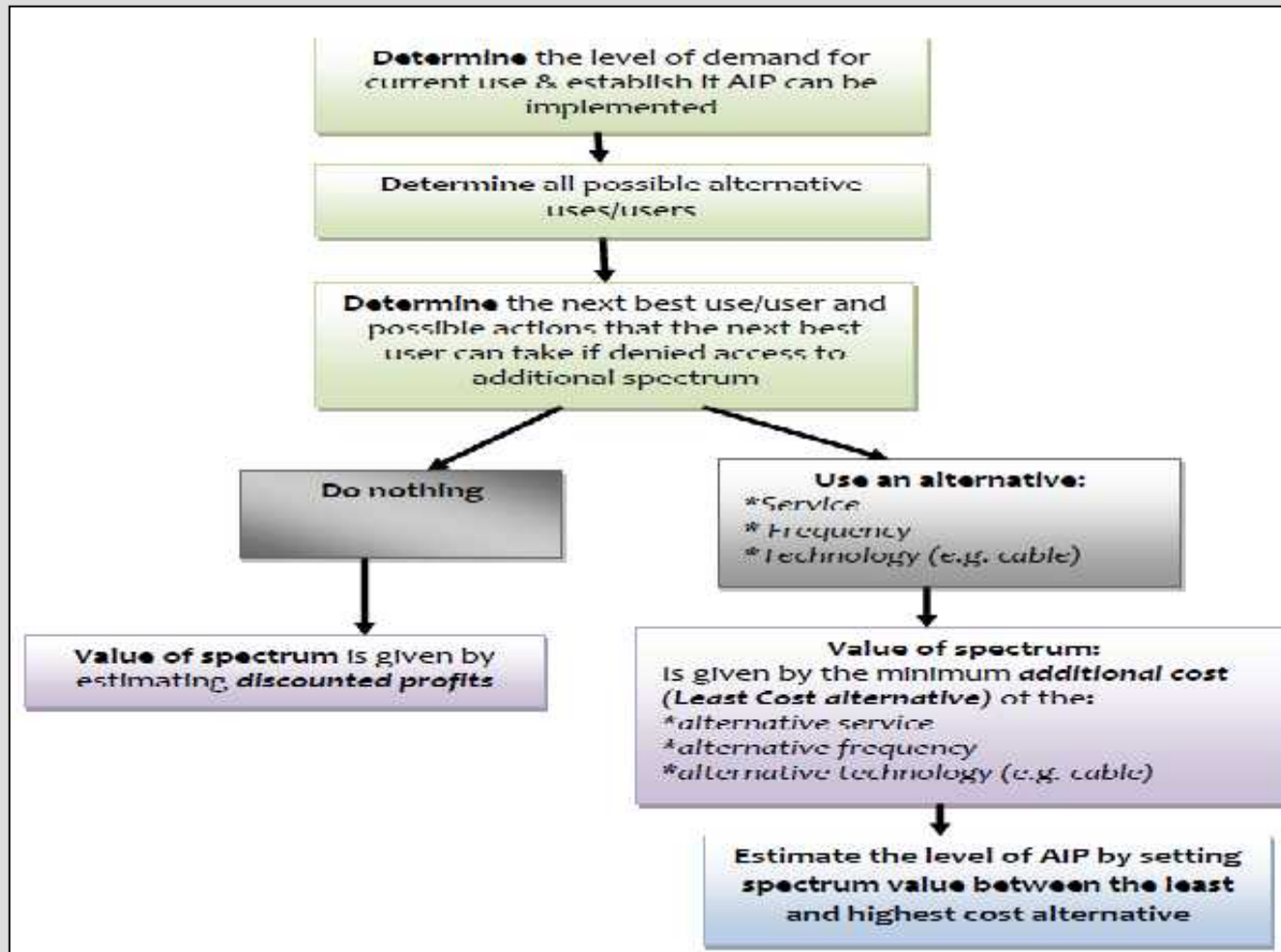
Closer Look at Market-based Methods - Auctions

- ▶ Market-based methods include auctions, administered incentive prices, and spectrum trading and leasing:
- ▶ Spectrum auctions are an important method for awarding licences and assigning spectrum authorizations for mobile services around the world.
- ▶ Auctions conceptually support best, the main regulatory objectives of technical and economic efficiency where market conditions permit competitive bidding. The typical indicators of auction “success” include some measure of participation (more is better), an absence of collusive bidding behavior and winning prices that reflect, more or less, the “true” value of the spectrum to winning bidders (that the auction is efficient).
- ▶ Auctions are particularly well suited for assigning high-value spectrum rights such as cellular and fixed links

Closer Look at Market-based Methods - AIP

- ▶ Setting an administrative price for spectrum equal to its opportunity cost is calculated by estimating what additional costs are incurred by a firm to produce the same services using incrementally less spectrum in a particular band or by having to utilize spectrum in the next cheapest band, or with a non-spectrum input (such as a fibre optic cable). Those extra costs measure the loss of opportunity to use the spectrum in question:

Closer Look at Market-based Methods - AIP



Other Methods – Economic Modelling

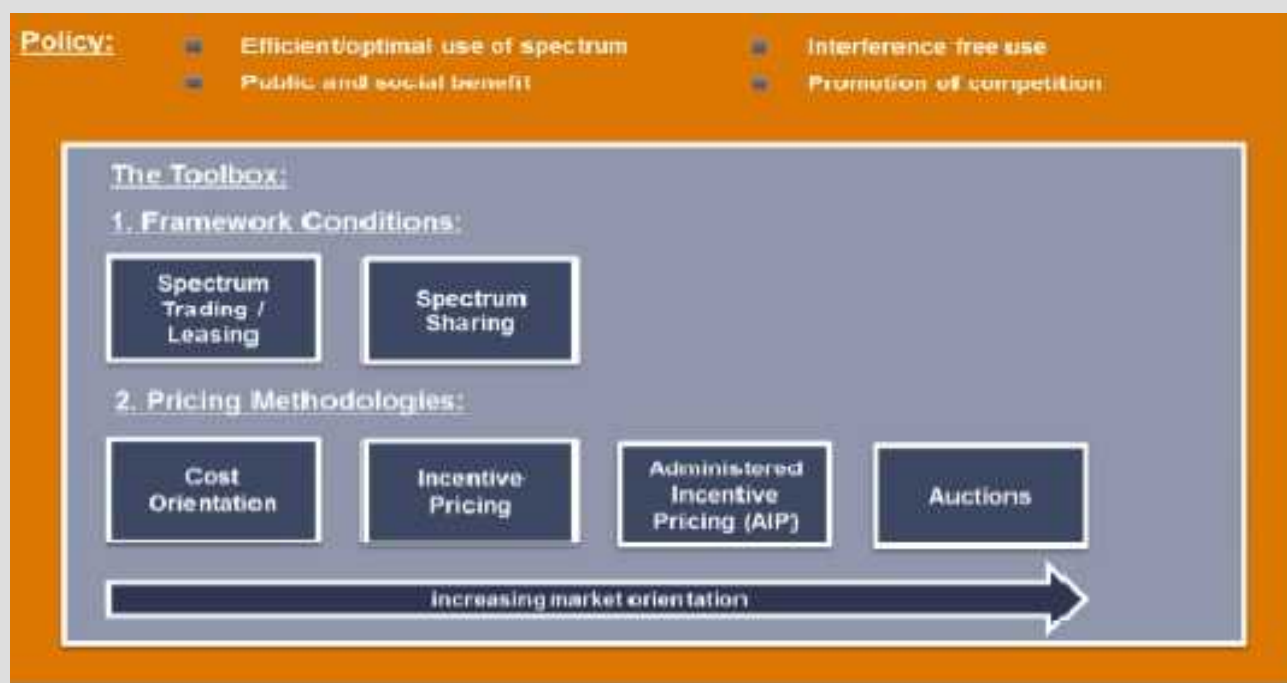
- ▶ Economic modelling allows the NRA to consider how changes in the raising or lowering of economic activity such as economic downturns, changes in taxation, and new trade relationships will affect performance in the sector and what adjustments, if any, to market structure and regulation are needed. Economic valuation modelling does not easily translate into specific valuations for radio spectrum.

Other Methods – Business Modelling

- ▶ A business-based valuation model assesses the value of spectrum from a commercial user's perspective. The exercise will be highly relevant to operators. The objectives for both the regulator and operator will converge at the point when spectrum values and resulting spectrum prices are optimal.
- ▶ The NRA is interested in economic and technical efficiency whereas the operator is interested in exploiting the profit potential of assigned frequencies. The principles of the business-based valuation approach involve estimating the value of profits over the model period by understanding how much profit the spectrum in question will be generated.

Preparing Administrative Spectrum Fee Schedules

- ▶ For most developing countries the regulator will typically begin with spectrum fees based on simple administrative formulas to recover spectrum management costs and contribute to government revenues and at a later stage once spectrum becomes scarcer should commence processes for introducing spectrum prices reflecting economic value using methods such as AIP, spectrum auctions, and spectrum trading. The figure below presents the spectrum policy/spectrum price toolbox:



Pro's and Con's of Various Spectrum Price Methods

Methods	Advantages	Disadvantages
<i>Simple fees</i>	<ul style="list-style-type: none"> Can be applied to all users of spectrum (public/private). Can be implemented without establishing a fee calculation model and fixing the level of the various fees based on various radiocommunication application Easy to implement and recovers some or all of the cost of issuing a license. 	<ul style="list-style-type: none"> The fee does not reflect the spectrum management costs of neither the regulator nor the value the user places on the spectrum. Applied alone it does not promote technical or economic efficiency in spectrum utilization
<i>Spectrum Management Cost Recovery</i>	<ul style="list-style-type: none"> Spectrum users are assured that they pay only for the costs connected with the spectrum management authority. Taxes collected from the general tax payers are not employed to finance activities of the administration whose beneficiaries are clearly identifiable 	<ul style="list-style-type: none"> Applied alone it does not promote technical or economic efficiency in spectrum utilization. It can become very complicated process to distribute direct and indirect costs of the spectrum management authority by mean of fee calculation models and tariffs. Due to legal restrictions it may happen that not all activities of the spectrum management authority can be financed with cost recovery fees.

Pro's and Con's of Various Spectrum Price Methods

Methods	Advantages	Disadvantages
<i>Incentive Factors</i>	<ul style="list-style-type: none"> ▪ Promotes efficient use of spectrum. ▪ Recovers some or all of the cost of issuing a license, although it is not the objective of such a fee 	<ul style="list-style-type: none"> ▪ Can require considerable effort to approximate market values. ▪ May not be suitable for all services.
<i>Fee based on opportunity cost</i>	<ul style="list-style-type: none"> ▪ Good approximation of the market value of spectrum. ▪ Promotes efficient use of spectrum 	<ul style="list-style-type: none"> ▪ Requires a huge amount of data and analysis. ▪ Only applicable to limited part of spectrum (account is taken only of users and uses competing for a given frequency band).
<i>Fee based on users' gross income</i>	<ul style="list-style-type: none"> ▪ Links the cost of spectrum to the value of the commercial activities that use it. ▪ Simple to calculate 	<ul style="list-style-type: none"> ▪ Can only be applied to users whose revenues are directly linked to spectrum utilization. ▪ Does not promote spectral efficiency if revenues not proportional to quantity of spectrum used. ▪ Can be seen as an extra tax.

THANK YOU !