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# Spectrum Management for the Future

Modern Best Practices of Spectrum Management

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## Foreword



*This presentation provides a compendium of modern best SM practice advices. It is thus an idealistic **vision**, and practical realisation of these advices may require careful consideration and gradual implementation*

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## Addressed Issues

- Efficient running of spectrum management organisation
- Improving efficiency of managed spectrum
- Promoting transparency
- Embracing technological neutrality
- Adopting measures allowing flexible use of spectrum
- Making spectrum available on timely basis
- International and regional harmonisation
- Making spectrum affordable
- Ensuring level playing field for all interested parties

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## Sources of information

	<p>ITU Handbooks: National Spectrum Management Annex 2: Best practices for national spectrum management Spectrum Monitoring Computer Aided Techniques</p>
	<p>Global Symposium for Regulators: Best practice guidelines for spectrum management to promote broadband access</p>
	<p>The ICT Regulation Toolkit is a joint production of infoDev and the International Telecommunication Union</p>

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## Efficient SM Organisation

- Aim:
  - To achieve efficient and smooth functioning of SM organisation, i.e. the National SM Authority
- Means:
  - Computer-assisted frequency assignment, making use of:
    - technical and licensing databases,
    - interference calculation models,
    - digital terrain maps
  - Computer-assisted frequency coordination:
    - compatible with ITU tools such as BR-IFIC and common data exchange with neighbouring countries
  - Computer-assisted spectrum monitoring, making use of:
    - spectrum monitoring databases,
    - work planning for regular monitoring and inspection
  - Computer-assisted licensing, making use of administrative databases linked with frequency assignment database, licence records, billing and fee collection
  - Lean organisational structure and efficient coordination between various national SM authorities and stakeholders
  - Professional development of staff, knowledge gathering through participation in ITU forums and work of regional organisations

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## Ensuring efficient spectrum use

- Aim:
  - Ensure most efficient use of limited spectrum resource through elimination of instances of inefficient use or hoarding of assigned spectrum
- Means:
  - Establish clear metrics for measuring the efficiency of spectrum utilisation by operators/users and apply them regularly
  - Make an attempt to set economic value to the spectrum, so that more economically efficient use of spectrum could become a factor in decision making
  - Perform independent regular audits of spectrum use, especially by “non-commercial” services, such as governmental/military users and other similar users who are not subject to incentive pricing
  - Provide swift and effective enforcement of spectrum management policies and regulations

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## Efficiency metrics

- ITU sources:
  - Handbook on National Spectrum Management
  - ITU-R Recs. SM.1046, SM.1599
- One simple example:
  - Efficiency of using GSM spectrum assigned to cellular operator:

$$SEF = \frac{N_{users}}{Block\_size [MHz] * Area [km^2]}$$

- Results could be used to compare efficiency of various operators, e.g. to decide who deserves award of additional spectrum

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## Transparency of SM operations

- Aim:
  - Promote transparent, non-discriminatory, and effective spectrum management policies, that provide regulatory certainty to market players
- Means:
  - Carrying out public consultations on SM policies and procedures:
    - before changing national frequency allocation plans; and
    - before making SM decisions likely to affect service providers.
  - Publication on the regulator's website:
    - forecasts of spectrum usage and allocation needs
    - frequency allocation plans
    - frequency register that gives an overview of assigned spectrum rights, vacant spectrum, and licence-free spectrum, taking into account any need for confidentiality and public security
  - Clearly defining and publishing, on the regulator's website and in an official gazette:
    - radio frequency spectrum users' rights and obligations
    - licensing and authorisation rules and procedures

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# Transparency example: UK (1)

http://spectruminfo.ofcom.org.uk/spectruminfo/

Latest Headlines

## Ofcom Spectrum Information System

Ofcom's Spectrum Information System (SIS) provides information on how radio spectrum is used in the UK, including the types of Wireless Telegraphy (WTR) Act licences available from Ofcom and details of tradable licences.

**Home**

- EFIS
- UKFAT
- UKPFA
- WTR
- TNR
- Apply for an Ofcom licence
- Help and FAQs
- About this system

**UK Plan for Frequency Authorisation (UKPFA)**  
The UK Plan for Frequency Authorisation (UKPFA) provides contextual information on different types of spectrum authorisations and licences, with links to further information.

**Wireless Telegraphy Act Register (WTR)**  
The Wireless Telegraphy Act Register (WTR) provides basic information about individual licences. At present, this information is limited to licences that can be traded.

**Transfer Notification Register (TNR)**  
The Transfer Notification Register (TNR) provides information on licences which have been traded or are in the process of being traded.

The Spectrum Information System also links to:

**European Frequency Information System (EFIS)**  
The European Frequency Information System (EFIS) displays information on spectrum available for different services and applications across Europe.

**UK Frequency Allocation Table (UKFAT)**  
The UK Frequency Allocation Table (UKFAT) identifies where spectrum management responsibilities lie with Ofcom, the Ministry of Defence, or another Government department or Agency.

**Top FAQs**

- What is the Spectrum Information System?
- The Spectrum Information System...
- What information can I find on the Spectrum Information System?
- There are three...
- How does Ofcom update the Spectrum Information System?
- The Spectrum Information System...
- More FAQs...



# Transparency example: UK (2)

**Home**

- EFIS
- UKFAT
- UKPFA
- WTR**
- TNR
- Apply for an Ofcom licence
- Help and FAQs
- About this system

## Wireless Telegraphy Register

I'm looking for this licence number:

OR

**Licence type**  
I'm looking for this sort of licence:

**Between these frequencies:**  
From  to

**In this area:**  
Enter the area centre point (in NGR format e.g. XX 123 456) and minimum search distance  
Search centre (NGR format)  minimum search distance +/-  km

OR

Or select an area on the map below:



# Transparency example: UK (3)

Home  
EFIS  
UKFAT  
UKPFA  
WTR  
TNR  
Apply for an Ofcom licence  
Help and FAQs  
About this system

Licence search results

[Start a new licence search](#)

All licences between 150 and 165 MHz \*  
\* Only showing tradable products

Licence number	Sector	Class	Licensee	Frequencies	Location(s)
0067158	Business Radio	Business Radio (Technically Assigned)	Radphone Limited	TX: 165.025 MHz RX: 160.525 MHz	SE 953 325
0028339	Business Radio	Business Radio (Technically Assigned)	Central Taxis (Aberdeen) Limited	TX: 163.45 MHz RX: 158.95 MHz	NJ 949 038
0028959	Business Radio	Business Radio (Technically Assigned)	Anthony Young	TX: 163.45 MHz RX: 158.95 MHz	NY 396 551
0067350	Business Radio	Business Radio (Technically Assigned)	Mr Malcolm Simm	Multiple frequencies found; see details for breakdown	SZ 568 784
0000372	Business Radio	Business Radio (Technically Assigned)	Mark Coates	TX: 163.475 MHz RX: 158.975 MHz	SJ 336 505
0038879	Business Radio	Business Radio (Technically Assigned)	James Aden	Multiple frequencies found; see details for breakdown	SJ 473 914
0058529	Business Radio	Business Radio (Technically Assigned)	ReadyPAY Limited	TX: 163.9375 MHz RX: 159.4375 MHz	NZ 312 817
0033770	Business Radio	Business Radio (Technically Assigned)	Mr Charles Hunter	Multiple frequencies found; see details for breakdown	SJ 403 844
0039569	Business Radio	Business Radio (Technically Assigned)	Radio Taxis (Fareham) Limited	Multiple frequencies found; see details for breakdown	SU 611 073
0033659	Business Radio	Business Radio (Technically Assigned)	T Whiteside & Sons Limited	TX: 163.525 MHz RX: 159.025 MHz	SD 324 289

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# Technology Neutrality

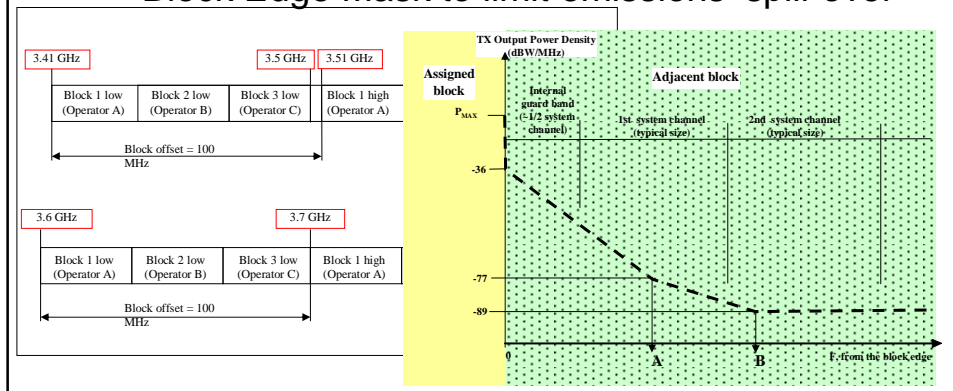
- Aim:
  - Create conditions for the development of new services, stimulate competition among different technologies
- Means:
  - Adopting decisions that are technologically neutral, i.e. refer to the service/application rather than the technological standard
  - Giving industry the freedom and flexibility to deploy their choice of technologies and decide on the most appropriate technology in their commercial interest
  - Ensuring that bands are not allocated for the exclusive use of particular services and that spectrum allocations are free of technology and service constraints, *as far as possible*

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# Technology Neutrality Example

- Frequencies for BWA at 3.5 GHz:
  - Describing principles for block assignment
  - Block Edge Mask to limit emissions' spill-over



# Flexible spectrum use policies

- Aim:
  - Introduce policies leading to flexible spectrum use so as to promote innovation and facilitate entry into market of new competitors
- Means:
  - Minimizing barriers to entry and providing incentives for small market players by allowing them to begin operations on a small scale, without onerous rollout conditions, to enable them gain experience and test market demand for various services
  - Adopting lighter regulations in rural areas, such as flexible regulation of power levels, the use of specialized antennas, the use of simple authorizations, lower spectrum fees
  - Recognizing that in markets where spectrum scarcity is an issue, the introduction of spectrum trading can in some cases foster innovation and free-up spectrum for new applications
  - Finding right balance of licence-exempt and licensed spectrum, balancing the desire to foster innovation with the need to control congestion and interference



## Timely availability of spectrum

- Aim:
  - Facilitate timely introduction of appropriate new applications and technology, while protecting existing services from harmful interference
- Means:
  - Make all available spectrum bands for offer, subject to overall national strategic spectrum master-plans, in order that prices are not pushed up due to restrictive supply and limited amount of spectrum made available
  - When appropriate, provide a mechanism to allow compensation for systems that must re-deploy for new spectrum needs (re-farming funds)
  - Where spectrum is scarce, promote spectrum sharing, including using interference mitigation techniques and economic incentives, to the extent practicable
  - Short-term pilot testing authorisations could be issued to promote the development of innovative wireless technologies
  - Consider creating incentives scheme to promote efficient sharing of bands by governmental & non-governmental users

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## International harmonisation

- Aim:
  - Align domestic spectrum policies with internationally recommended, in order to achieve faster take-up of new bands and economies of scale
- Means:
  - Adopting harmonised frequency plans defined by ITU-R and regional bodies in order to facilitate implementation of competition
  - Working on international/regional level to develop coordinated regulatory practices
  - Utilising regional and international standards whenever possible, and where appropriate, reflecting them in national standards
  - In lieu of national regulations, relying to the extent possible on industry standards including those that are included in ITU Recommendations

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## Affordability of spectrum access

- Aim:
  - Reducing financial barriers and promoting development of wireless technologies
- Means:
  - Apply reasonable spectrum fees for wireless technologies to foster the provision of innovative services at affordable prices, and minimise costs that may become barriers to entry for new operators
  - Assist the economic viability of wireless technologies in rural and under-served areas through targeted application of reduced costs of access to spectrum
  - Auctions and tender processes can also be managed to meet these goals

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## Ensuring level playing field

- Aim:
  - Ensure that all wireless players have equitable and fair access to spectrum resources
- Means:
  - Assure open and fair competition in the marketplaces for equipment and services, and constantly work on removing any identified barriers that arise to open and fair competition
  - Remove any regulatory barriers to free circulation and global roaming of mobile terminals, SRDs and similar radiocommunication equipment
  - Remove any preferential treatment of domestic technologies/operators, allow free play for global communications technologies, such as satellite communications
  - To prevent spectrum hoarding, especially by incumbents, regulators can set a limit on the maximum amount of spectrum that each operator can obtain

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## Conclusions

- The above set of advices represents the “guiding lights” that may be used for setting directions for gradual build-up of national spectrum management practices
- Some of the suggested actions may be difficult and expensive to implement, but even gradual advancement towards the goal will make for important development

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## Thank you!

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*Sapere Aude*

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