



Implementing spectrum trading in Europe

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21 October 2003

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- Implementation issues
 - Case studies of potential trades
- Current status of implementation across Europe

The European environment is different from other locations where spectrum trading has been implemented

- Demand for spectrum:
 - higher population density leads to increased spectrum scarcity
 - lower availability of spectrum for key services
- Challenges associated with implementing spectrum trading:
 - length of border regions resulting in greater need for international co-ordination of radio frequency use
 - numerous bilateral agreements in place

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We expect two main categories of spectrum trade to arise in Europe

- ① • High-value, high-profile transactions between major organisations generating significant economic benefits
 - these are likely to be relatively infrequent
 - quite likely to involve change in technology/ service and have significant interference implications
- ② • On-going low-value transfers between users
 - significantly higher volume of transactions
 - majority likely to comprise straightforward change of ownership

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Several key parameters affect the implementation of spectrum trading

- Nature of spectrum:
 - bandwidth, geography, time period
 - licence duration
 - interference obligations/ protection
- Financial considerations:
 - annual licence fees
 - windfall gains
- Flexibility/ease of reconfiguration:
 - bandwidth, geography, time period
 - change of technology, service
- Trading mechanisms:
 - brokers/resellers
 - regulatory approval

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We present two case studies to illustrate how the 'optimal' parameters may vary, depending on the nature of the trade

- Case study 1:
 - national terrestrial broadcaster sells spectrum to a cellular operator
- Case study 2:
 - fixed-link user sells spectrum to another user of fixed links

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Case study 1: Broadcaster/cellular operator trade – background

- 2005 – a GSM1800/UMTS operator is reviewing its strategy:
 - 3G services (finally!) starting to be successful
 - 3G deployment in urban areas is mostly complete
 - cost of rural coverage (2GHz) looks prohibitive
 - threat of 400/450MHz CDMA2000 new entrant (change of technology)
- National terrestrial TV broadcaster is also considering:
 - commercial/political imperative for switchover to digital
 - how to fund transmission infrastructure/'forced' migration

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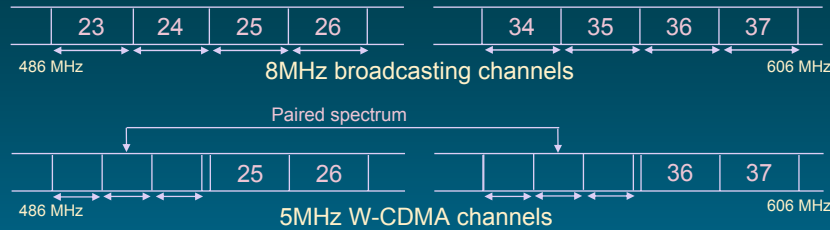
By 2007, an outline agreement is in place for implementation in 2010

- Broadcaster and cellular operator reach outline agreement:
 - broadcaster to sell part of its UHF spectrum holdings to cellular operator
 - funds received to be used to deploy additional digital transmitter sites, invest in new programming and migrate 'stragglers'
 - cellular operator's cost of providing rural 3G coverage falls dramatically – additional capacity in urban areas?
- Transfer of frequencies to occur in 2010

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The cellular operator will wish to purchase paired 5MHz spectrum blocks



- If reconfiguration of the spectrum is permitted, the broadcaster may sell blocks of 2 x 5MHz of spectrum to the cellular operator
- Alternatively, the broadcaster may need to sell two sets of two adjacent 8MHz channels

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Interference issues in border regions will require careful management

- Interference will occur as neighbouring countries continue to use the same/adjacent frequencies for broadcasting:
 - from cellular base stations and mobile transmitters to unprotected conventional analogue television sets
 - from high power broadcast transmitters to cellular base stations (and possibly mobile receivers)
- There could also be other interference modes:
 - e.g. intermodulation products generated in TV receivers
- The cellular operator will need to reach agreement with broadcasters in adjacent countries:
 - this could be a lengthy and challenging process

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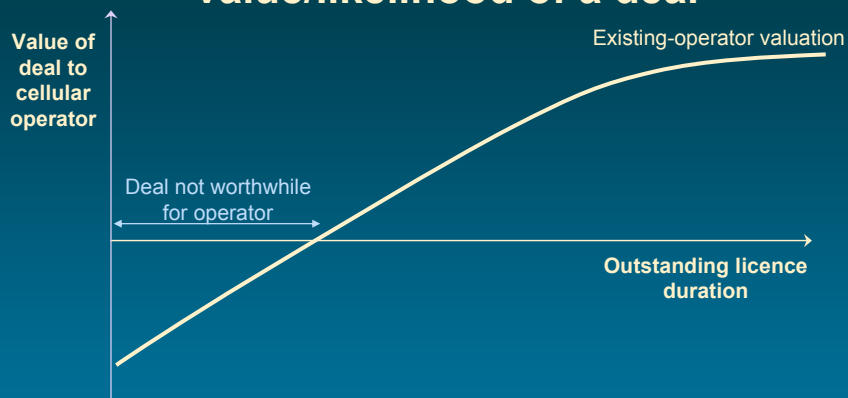
Implementing a 'change of service' also depends on international agreements

- Radio regulators protect broadcasting and fixed-service users as the primary subjects of allocation in Bands IV and V:
 - mobile use in the band is therefore subject to interference from these users
 - cellular transmissions must not interfere with broadcast transmissions
- RRC in 2004 will develop a frequency plan for digital broadcasting within the bands:
 - final agreement to be reached in 2005/6

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The outstanding licence duration affects the value/likelihood of a deal

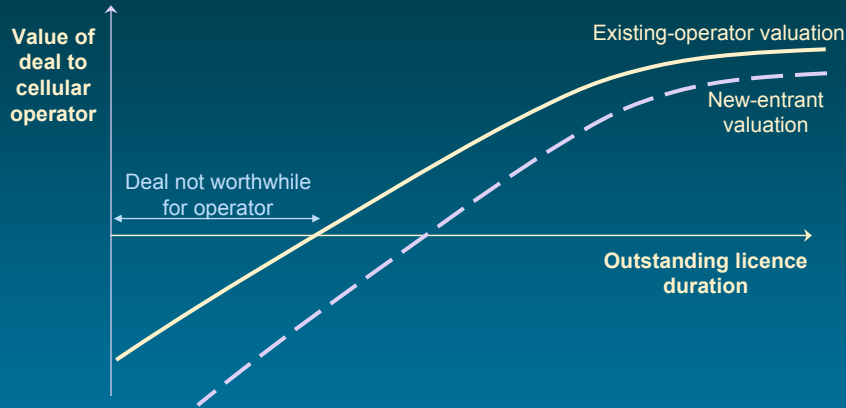


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Time

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The outstanding licence duration affects the value/likelihood of a deal

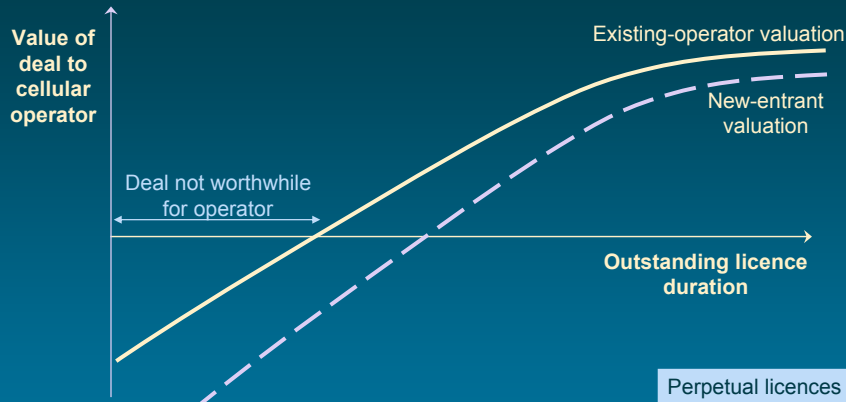


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Time

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The outstanding licence duration affects the value/likelihood of a deal



Fixed licence duration

Licence tradable

Licence not tradable

Time

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Deal value will also depend on annual licence fees and any windfall taxes

- Ongoing licence fee payments (particularly those set as a result of economic incentive rather than on a cost-recovery basis) will reduce the 'price' paid by the cellular operator
 - ongoing fees are a further incentive for the broadcaster to release spectrum (as they represent a potential cost saving)
- Windfall taxes will act as a disincentive to the broadcaster:
 - the 'revenues' from the trade must be discounted by any taxes to be paid
 - the feasibility of the deal will depend on whether the costs of the broadcaster are still covered

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Third-party brokers are unlikely to be required

- Details of the frequency assignments held by the seller are already likely to be in the public domain
- Both buyer and seller are sufficiently well known to approach each other directly
- Buyer and seller are sufficiently large/knowledgeable to have the technical and commercial expertise needed to negotiate and execute the deal

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Regulatory *ex ante* approval of the deal is likely to be acceptable to both parties

- A six-month wait for approval is unlikely to affect the feasibility of the deal:
 - time will be required to undertake assessments of co-ordination zones etc. with neighbouring countries
 - all interference issues do not need to be solved prior to introducing principle of spectrum trading
- The regulator's approval procedure should not be open to exploitation by third parties:
 - e.g. by other cellular operators to delay implementation

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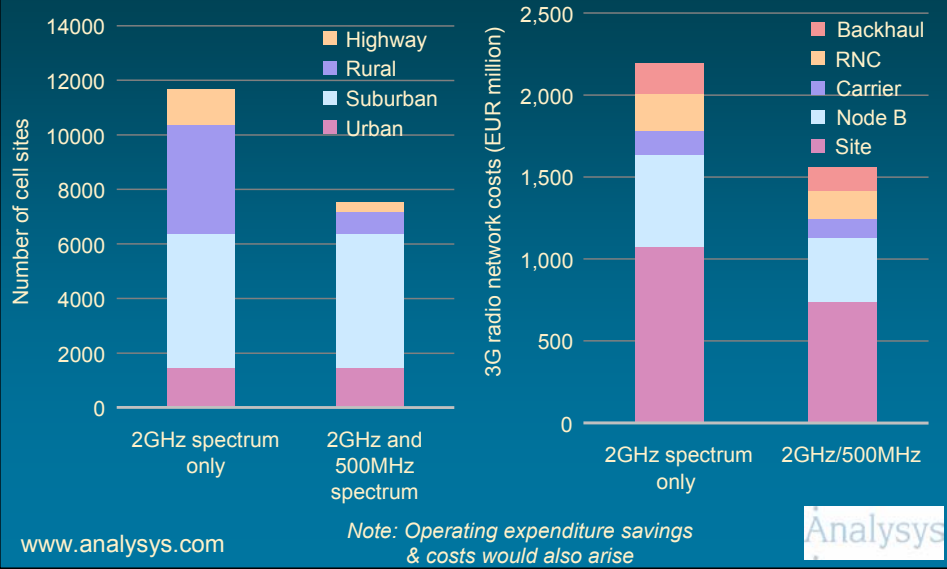
Summary of benefits of the trade

Broadcaster	Cellular operator	Society
<ul style="list-style-type: none"> •Faster migration to digital •New channels reach wider audience •Cash sum/savings for broadcaster: <ul style="list-style-type: none"> •funds for investment in new programming •profit on trade 	<ul style="list-style-type: none"> •Improved coverage/ quality of service •Major capex and opex savings <ul style="list-style-type: none"> •significant reduction in cell-site numbers •BUT possible additional handset costs 	<ul style="list-style-type: none"> •Increased digital programming •3G in rural areas (removal of digital divide) •Higher cellular network quality •More cellular providers? •Potentially lower prices

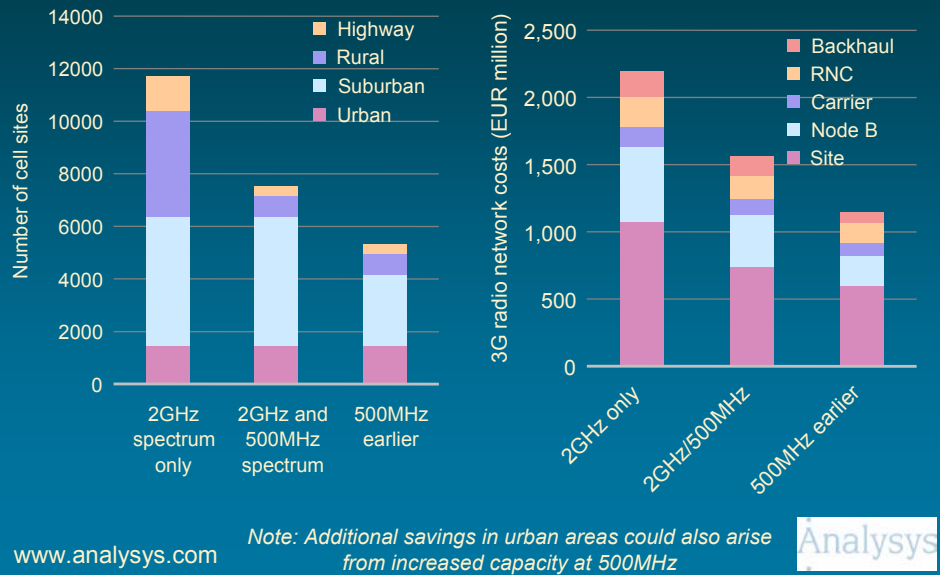
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A UK cellular operator could save over 600 million Euros in rural coverage costs



Greater savings would arise if the operator could obtain the spectrum earlier



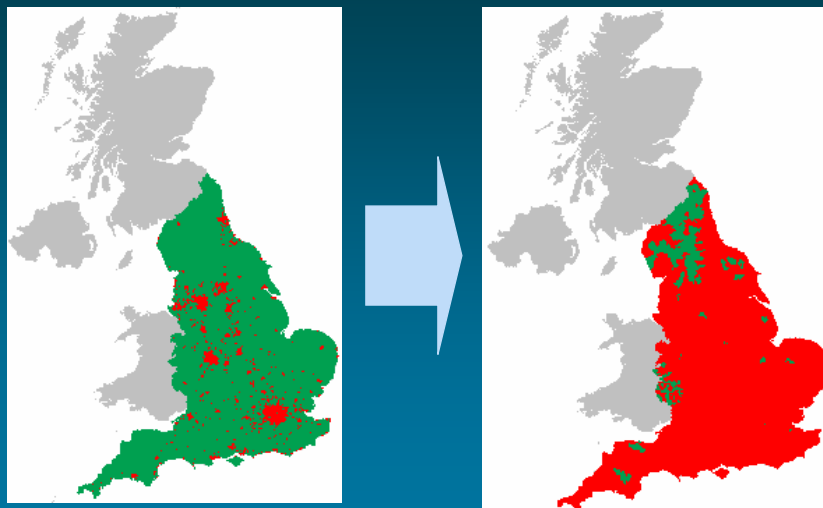
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The use of UHF broadcast spectrum for 3G could help to remove the 'digital divide'



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Example of enhanced 3G coverage in England

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Summary of benefits of the trade

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Case study 2: Trading between two fixed-link users – background

- 2005 - A small start-up telecoms provider wishes to obtain a 7.5GHz fixed link to provide backhaul connectivity for its local WiFi service offering
- A major telecoms provider plans to introduce spectrally efficient technology on some of its fixed links allowing it to release 30% of its current fixed link spectrum holdings (including the 7.5GHz band)

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A spectrum broker is able to 'connect' the two organisations

- The start-up telecoms provider registers details of its requirement for a 7MHz fixed-link channel in the 7.5GHz band in the vicinity of Cambridge, UK, on a spectrum broker's Web site after the regulator is unable to meet the operator's request
- The major telecoms operator calls a number of spectrum brokers to highlight its willingness to sell excess fixed-link spectrum in a variety of frequency bands, but in certain specific locations
- Comparing the requirements of both organisations, the broker is able to match seller with potential buyer

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Some co-ordination is required to ensure there is no interference

- Because the precise locations of the fixed-link transmitters vary, the regulator undertakes a frequency co-ordination exercise:
 - rapid turnaround time (few days) is critical, as alternative solutions will otherwise be sought
- Formal specification of spectrum rights (geographical coverage, acceptable power flux densities) may not remove the co-ordination requirement:
 - spectral efficiency enhanced by consideration of totality of use in area
- Spectrum management organisations could take on the co-ordination role from national regulators

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Valuation is again dependent on licence duration and annual spectrum fees

- Shorter licence durations are acceptable – although again perpetuity provides greater confidence
- Existing annual spectrum fees will again reduce the 'price' of the trade:
 - fees that fully reflect the economic value of the spectrum will result in spectrum being returned directly to the government
 - annual fees which are based on a conservative valuation of the spectrum (e.g. marginal value) will, in most cases, leave sufficient financial incentive to encourage trading to occur

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Summary of benefits of the trade

Start-up operator (buyer)	Major operator (seller)	Society
<ul style="list-style-type: none">• Enables operator to rapidly commence service offering	<ul style="list-style-type: none">• Revenues/licence fee savings to be used for purchase of spectrally efficient equipment	<ul style="list-style-type: none">• Increased competition in telecoms provision/provision of services not previously available

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Parameters which maximise the likelihood of a trade

	Broadcaster/ cellular operator transaction	Fixed-link transaction	Notes
Division of spectrum into trading units			International co-ordination
Perpetual licence duration/ rolling licence			Low cost of microwave equipment
No requirement for regulator's prior approval			Broadcast deal – long timescale
Annual licence fees			Dependent on charges (economic value/cost recovery)
Existence of spectrum brokers			Awareness of buyers and sellers

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Some final thoughts ...

- The introduction of spectrum trading should not be delayed whilst all implementation issues are resolved:
 - division of spectrum into standardised units will only assist a small number of trades
 - interference issues arising from a change of technology will require detailed investigation in any case if spectral efficiency is to be maximised
- The rights and obligations associated with a licence do need to be clear for trading to occur (especially licence duration)
- The volume of complex trades is likely to be modest:
 - regulators should be able to manage these on a 'case-by-case' basis in the initial period of trading
- Reviews of individual trades will aid development of general trading policies

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- Implementation issues
 - Case study 1: Trading of spectrum between television broadcaster and cellular operator
 - Case study 2: Trading of spectrum between two users of fixed links
- Current status of implementation across Europe

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This section of the presentation draws upon material being developed in a study for the European Commission

“Study on conditions and options for introducing secondary trading of radio spectrum in the European Community”

Analysys Ltd, DotEcon Ltd, Hogan & Hartson L.L.P.

Notes:

- (1) The study began in September 2003 and is expected to be completed in May 2004. The total value of the contract is EUR398 550
- (2) The material presented in this section is that of Analysys Ltd and its partners and should not be taken in any way to represent the views or position of the European Commission
- (3) Country perspectives are based on initial telephone discussions with the regulator/Ministry

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Cellular, broadcast, PMR and fixed link spectrum is currently most scarce

Services in which demand for spectrum exceeds current availability

Austria	Cellular, broadcast	Greece	PMR, wireless mics
Belgium	Broadcast (FM radio), PMR (urban areas)	Holland	Overall scarcity, especially in GHz bands
Denmark	Cellular, broadcast, FWA	Italy	No specific areas
Finland	Cellular	Norway	No major scarcity issues
France	Broadcast (TV), GSM	Spain	GSM, PMR/PAMR, fixed, broadcast, emergency
Germany	Cellular	Sweden	Cellular

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Plans to introduce spectrum trading (1)

	Trading in new law	Notes
Austria	✓	Trading of regulator assigned licences; trades examined by regulator on case by case basis - reconfiguration OK
Belgium	✗	Previous negative experience with interference and abuse
Denmark	✗	No current pressure to introduce, but may be allowed in future
Finland	✗	Not consistent with free access to spectrum
France	✓ (next few months)	Trading of rights of use (rather than frequencies), approval required where public services involved
Germany	✓ (next year)	No pre-defined rules - each trade examined on a case-by-case basis by regulator

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Plans to introduce spectrum trading (2)

	Trading in new law	Notes
Greece	TBC	Under consideration
Italy	✓	Trading where licence numbers are limited; case by case review of trades; change of use allowed if no interference
Norway	✓	Transfers and change of use already common; Ministry can block trade based on competition/interference issues
Spain	✓ (Nov 2003)	Detailed regulations to be developed by 2004
Sweden	✓	Case-by-case review – reconfiguration/change of use allowed, no change of use to EU harmonised bands
UK	✓	Implementation proposals currently under development

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If you are interested in receiving updates on the Analysys study for the European Commission, please send your contact details to:

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Analysys provides a range of spectrum management services

Regulators	Developments in spectrum policy Evaluation of licence bids Licence fee determination/spectrum pricing Frequency band planning/migration strategies Modelling of future demand for spectrum for different radio communications services Spectrum trading frameworks Policy on the provision of unlicensed spectrum	Improvement of spectrum management Development of national frequency allocation plan Establishment of core framework and service-specific regulations Institutional strengthening – organisational and process enhancement Procurement of frequency management and spectrum monitoring systems
Users	Modelling of future spectrum requirements Spectrum valuations – assessment of capex and opex savings from access to additional frequency channels Assessment of implications of new government regulations	Preparing formal responses to official consultations Assistance with informal lobbying activities Turnkey licence application production Auction strategy and bid tactics

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