Open Spectrum Alliance (OSA) response to the European Commission's public consultation on possible content of a multiannual radio spectrum policy programme

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http://www.openspectrum.eu

OSA appreciate the opportunity to contribute to the Commission Services' process for developing proposals for a multiannual radio spectrum policy programme (RSPP). RSPP is an important undertaking which, if done well, will enhance the predictability, coherence and effectiveness of policymaking at the regional level. That, in turn, will facilitate planning by government institutions and businesses and encourage investment in new services and communication infrastructures.

However, such a Programme could also reduce flexibility in responding to unforeseen needs and situations. Therefore, it is important for the RSPP to be based on the best available advice and evidence as well as a farsighted analysis of the main trends in technology, policy, society and the economy.

In our view, European spectrum policy must align with at least these dominant trends to be future-proof and ready for the issues bound to arise during the next 5 years:

- First is the proliferation of new authorisation classes *between* "licensed" and "unlicensed".
- Second is the constantly growing demand for spectrum.
- Third – a corollary of growing demand – is the need to continually increase the capacity of spectrum by improving technology and the efficiency of band utilisation.
- Fourth is the exploitation of higher frequency bands whose characteristics are very different from lower frequencies.

We will briefly consider some of the implications of these four trends before tackling the consultation document's questions.

Trend 1: Proliferating authorisation classes

ECC Report 132 (June 2009)[1] considers the creation by national regulatory authorities of new authorisation classes in the semantic zone near "licensed" and "unlicensed". This development is already underway and will probably spread to more bands and services. The ECC Report found significant differences in terminology from country to country as well as varied implementations of "light licensing". In addition to recommending the harmonisation

[1] "Light Licensing, Licence-Exempt and Commons" – http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP132.PDF

of meanings and terminologies, the Report recommends "to avoid in the future using in an ECC deliverable the terminologies '*Licensed*' and '*Unlicensed*'"[2]. Instead the ECC recommend using "general" and "individual" authorisation.

We support this newer terminology and what it represents: it is a soft path to liberalisation, as well as a vocabulary shift of historic significance. Consistent reference to *authorisation* rather than *licensing* in Europe's official documentation concerning radio will, at the very least, discourage contortions of logic like the use of "class licenses" to approximate "license exemption".

But there are also insufficiently explored consequences to the development of new authorisation classes which need to be considered at the regional level lest they undermine harmonization:

- In the future will auctions be used to award licenses *only*, or will bidders be able to acquire different bundles of authorisation rights for the same channels at different prices?[3]
- How might that affect the market value of "spectrum"?
- Will licensees be able to synthesize authorisation schemes not created by regulators by offering novel combinations of sub-rights?
- Will only licenses be tradable, or can sub-rights packages enter the secondary market, too?
- Could someone gain control of a licensed band by cornering the market in a particular sub-right without becoming a licensee?

Such questions are challenging but it is not too early to put them on the policy agenda (they relate directly to **Question 17** in the consultation document).[4]

Trend 2: Growing demand for spectrum

"Radio technology has never developed so many competing services so fast since its public expansion in the early 1920s…"[5] As a result, new demands for frequencies are piling up with no end in sight. There is an obvious need for much more band sharing in the future, between new and legacy services, services with differing spectrum usage rights, and between service-specific and service-neutral band occupants (as may be found someday in UHF "white spaces"). This is likely to draw regulators into new conflict resolution scenarios, or it might lead to the delegation of responsibilities for dealing with interference problems to user groups and/or nongovernmental band managers. At the EU level, there will be added value in sharing "best practices" and agreeing the use of standards and protocols to encourage market-based solutions to band sharing between dissimilar services.

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[2] *op. cit.*, page 6.

[3] This possibility is explored in "Next Generation Spectrum Regulation for Europe: Price-Guided Radio Policy" by Kenneth R. Carter, WIK Discussion Paper No. 326 (30 November 2009) - http://ssrn.com/abstract=1522038.

[4] Some of these questions are likely to be posed in Karen Wrege's presentation at the 5th Annual European Spectrum Management Conference in Brussels (22-24 June 2010): "Combinatorial auctions: are bidders ready for change?" – http://www.eu-ems.com/agenda.asp?event_id=38 &page_id=230

[5] "Annex 3: Implications of Alternative Wireless Technologies for Europe and Policy Recommendations -- Final Report for the project 'Mapping European Wireless Trends and Drivers'" by Erik Bohlin, Sven Lindmark, Simon Forge and Colin Blackman, Institute for Prospective Technological Studies (November 2005) -- ftp://ftp.jrc.es/pub/EURdoc/Annex3.pdf

The consultation document has already identified refarming as an important issue for the RSPP to address (**Questions 15** and **16**). Here we only highlight the connection between refarming and recent comments by Commission Vice President Neelie Kroes. Speaking to the EU Spectrum Summit last month, Ms. Kroes said:

> "We should assume nothing beyond the need to maximise the social, economic and environmental value that spectrum can be used to generate… I am keen to avoid newer and better technologies being at a disadvantage simply because they came later… If the potential of a spectrum allocation is not being exploited to its maximum, if the application is not the most efficient way of delivering social, cultural or economic benefits, then it should go to another application or service instead. We should not therefore be afraid, in duly justified case, to reallocate spectrum which is not fully or not efficiently used…"[6]

We strongly support Ms. Kroes' position, even though it is contrary to an established practice in radio regulation of giving earlier authorised users of a band priority over later users – the so-called "first come, first served" policy. That applies to licensees more than to service allocations, but regardless, Ms. Kroes' "clear and strong policy line" is sure to provoke opposition from incumbents who were not previously expected to demonstrate efficient spectrum use in order to retain their licenses. Government agencies which only use spectrum under specific or unusual conditions may find this quite problematic. Yet all incumbents will want to know if this personally expressed position will become the Commission's. Ms. Kroes' remarks should spark a debate among policymakers about incumbents' rights in refarming and how to reconcile the "first come, first served" tradition with the urgent need to maximise spectral efficiency and accommodate the growing demand for wireless bandwidth.

Trend 3: Improving spectral efficiency to increase capacity

While there is no end in sight to new demands for spectrum access, there is also no end in sight to the radio spectrum's information carrying capacity – so long as spectrum is used more and more efficiently. To put that another way, our second trend (growing demand for spectrum) produces a need to continually increase the carrying capacity of spectrum by improving efficiency of use.

According to mobile phone pioneer Martin Cooper, "the number of 'conversations' (voice or data) that can theoretically be conducted over a given area in all of the useful radio spectrum... has doubled every two-and-a-half years for the past 104 years."[7] The US Commerce Department's Spectrum Management Advisory Committee (SMAC) recently affirmed that claim and indicated it could remain valid for at least 50 more years:

> "Although the chart [below] depicts linear change, improvements actually occurred in spurts, stimulated by market imperatives (i.e., land mobile) or by government requirements (cellular). The potential to achieve further improvement through modulation methods, time division, or extending the upper limits of spectrum use has been almost exhausted. Geographic sharing, in the form of MAS (multi-antenna

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[6] "Radio spectrum – why Europe needs effective co-ordination", speech by Neelie Kroes, Vice President of the European Commission and Commissioner for the Digital Agenda, at the Spectrum Summit, European Parliament, Brussels, 23 March 2010 - http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/10/115

[7] See the "Cooper's Law" page at Arraycom – http://www.arraycomm.com/serve.php?page=Cooper: "Of the million times improvement in the last 45 years, roughly 25 times were the result of being able to use more spectrum, 5 times can be attributed to the ability to divide the radio spectrum into narrower slices – frequency division. Modulation techniques... can take credit for another 5 times or so. The remaining sixteen hundred times improvement was the result of confining the area used for individual conversations to smaller and smaller areas – what we call spectrum re-use..."

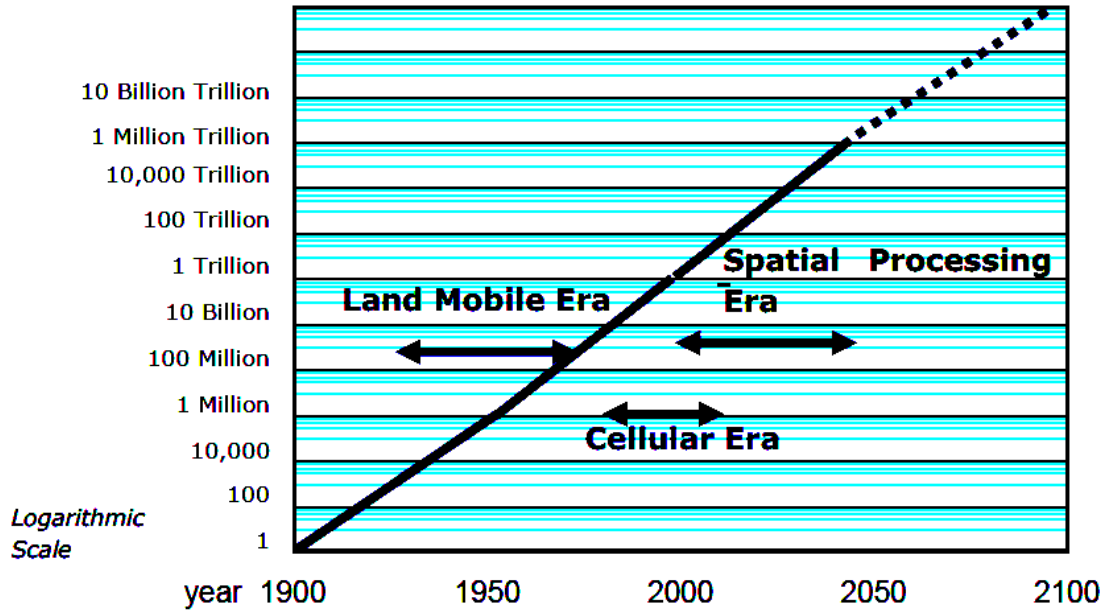

Chart showing steady increases in the number of messages which can be transmitted simultaneously in a certain geographic area using the available spectrum; from the Spectrum Management Advisory Committee's "Definitions of Efficiency in Spectrum Use" (US Commerce Department, 2008)

> signal processing – also known as 'smart antenna', MIMO, adaptive arrays, etc.), however, has the potential to extend the improvements well into the future…"[8]

In other words, "beam-forming" (the focusing of radio energy and detection sensitivity only in desired directions) and exploiting propagation effects like multipath could lead to major improvements in spectral efficiency in the decades to come. Such techniques are rather expensive now and difficult to implement in handheld devices, but they are likely to become the norm soon in fixed infrastructures.

So while there is no danger of our ever "running out of spectrum", for some mobile applications there may be a risk of running out of *cheap* spectrum in the near term. Regulators can play a useful role in responding to such short-term "bottle necks" by refarming intelligently, and in countering the disincentive of higher equipment costs in the long term by proposing minimum technical standards for efficient use of spectrum. That may require some contracted studies or public consultations early in the multiyear work plan, since spectrum is just one input in a communications system and there are trade-offs: spending more on base stations might reduce the radio bandwidth needed to achieve a high throughput, while making the service too expensive to attract customers. Maximising the overall net benefit to society should be the goal and that may imply a different optimum than designing a system simply to conserve spectrum. So finding the best blend of *spectral efficiency* (using the least amount of spectrum to transmit the greatest amount of information) and *economic efficiency* (creating the most value with the least – or least costly – inputs) is a challenge, with a potentially big payoff.[9]

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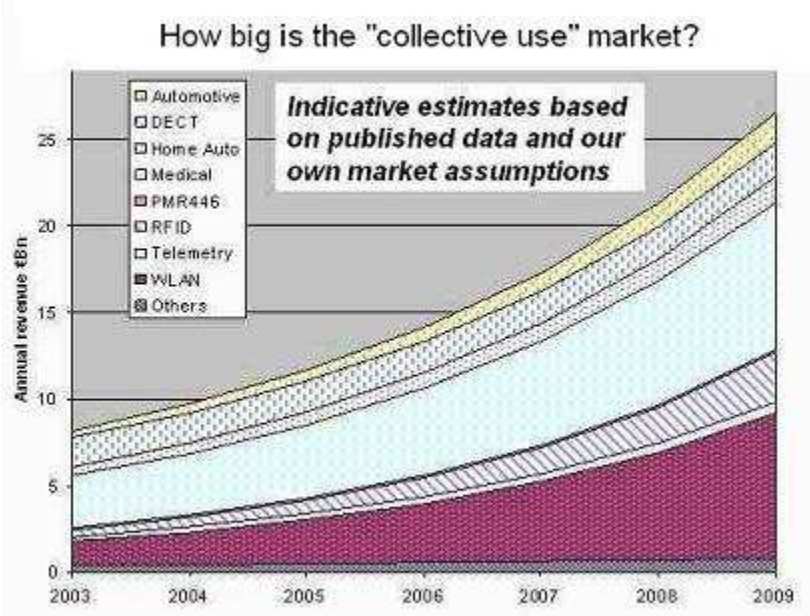
[8] "Definitions of Efficiency in Spectrum Use" by the US Commerce Department's Spectrum Management Advisory Committee (1 October 2008) –http://www.ntia.doc.gov/advisory/spectrum/meeting_files/Spectral_Efficiency_Final.pdf

[9] A project named "End-to-End Efficiency" is currently funded under FP7, but its aim is more specialised. See https://ict-e3.eu/project/overview/overview.html

One proven way to boost efficiency and increase social benefit is by increasing the allocation of spectrum subject to general authorization only.[10] As the 2.4 GHz band demonstrates, such bands can accommodate many more users and more diverse applications than bands for individually authorised use. Eliminating frequency assignments and state-guaranteed interference protection zones allows for denser packing of users while encouraging the development of innovative, interference-resisting equipment. The economic significance of applications in these bands has grown large very quickly and at least some of the applications provide more benefit to society (per MHz) than even the most beneficial activities in licensed spectrum.[11]

Graph at right is from *Final Report: Study on Legal, Economic and Technical Aspects of 'Collective Use' of Spectrum in the European Community*, (November 2006)[12]



Cognitive radio also promises more intensive and efficient use of spectrum, although it also challenges some of the assumptions on which the current R&TTE procedures are based. That, along with the poor results of the 3rd Joint Cross Border R&TTE Market Surveillance Campaign,[13] suggest that a review of the R&TTE Directive should be part of the RSPP.

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[10] Under the Authorisation Directive, bands operating under general authorisation do not need specific economic justification.

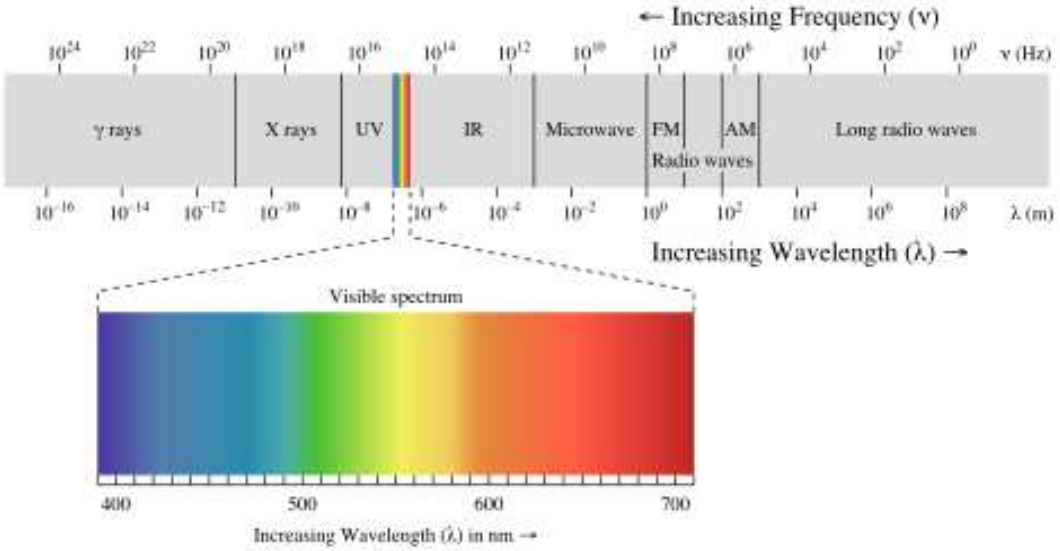
[11] "…use of RFIDs in the retail sector is the highest value application per MHz of bandwidth... even if the RFID spectrum allocation were increased by a factor of 10 to deal with spectrum scarcity, it is likely that the value per MHz generated by use of RFIDs in the retail sector will still exceed that of mobile telephony and broadcasting..." Other high-value applications in the general authorization bands are: public access to the Internet via Wi-Fi; home data networking; wireless building automation systems; and utilities telemetry. Quote is from page 52 of *The economic value of licence exempt spectrum*, Indepen, Aegis and Ovum (2006) – http://www.aegis-systems.co.uk/download/1818/value.pdf.

[12] By Mott MacDonald Ltd., Aegis Systems Ltd., IDATE, Indepen Ltd. and WIK Consult – http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/_document_storage/studies/cus/cus_rep_fin.pdf

[13] Conducted in 2008-9, this campaign focused on equipment for the 2.4 GHz band and Private Mobile Radio. Less than 16% of the examined products complied with the requirements of the R&TTE Directive – an astonishingly low result. See "Report on the Third Joint Cross Border R&TTE Market Surveillance Campaign" by the European Market Surveillance Authorities - http://ec.europa.eu/enterprise/sectors/rtte/files/3rd_rtte_market_surveillance_campaign_report_en.pdf.

Trend 4: Moving into higher bands

Throughout the history of radio, the upper limit of usable frequencies has moved higher.[14] The usable spectrum is now so large that a logarithmic scale is often used to represent it, with each "decile" (1-10 MHz, 10-100 MHz, 100-1000 MHz) rendered equal in size, as in the chart below. This misrepresents the relative abundance of higher frequencies, however. The spectrum between 1 and 2 THz is a hundred times larger than all the commercially developed bands below 10 GHz, even though it appears much smaller than the 0-10 GHz range.



"Off the shelf" equipment is available today for most bands below 90 GHz, but only a few experimental prototypes operate between 90 and 400 GHz. However, there has been great progress in turning those prototypes into devices suitable for mass production at reasonable cost, should demand develop.[15] In the terahertz range (above 1000 GHz), breakthroughs in design concepts and fabrication techniques are being driven at a fast pace by the demand for security equipment which can see through clothing and detect concealed weapons and explosives. Terahertz scanners are now being installed in airports around the world. Meanwhile, researchers have turned ordinary LEDs into high-speed data relays, using visible light as the carrier.[16] Electromagnetic waves are hardly scarce.

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[14] In 1932 the upper limit of the international frequency allocations table was 30 MHz. In 1938 this was raised to 200 MHz. In 1947 the limit was raised again, to 10.5 GHz. In 1959 it went up to 40 GHz. And so on. The ITU's definition of "radio" today includes all frequencies below 3000 GHz.

[15] The Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia is developing an integrated circuit for transmissions in the 180-220GHz band which relays data at 80GB/s. They say the chip is "more cost and power efficient than current wireless chips [and] can be used in both indoor and outdoor wireless networking." See "CSIRO speeds wireless chip to 80 gigabits per second," by Mitchell Bingemann, *ComputerWorld*, 13 April 2007 - http://www.computerworld.com.au/index.php/id;1568566448;fp;16;fpid;1. Meanwhile, engineers at the University of California at Los Angeles achieved the highest frequency ever generated with a CMOS chip – 324 GHz – and asserted that minor changes in the design would enable operation up to 600 GHz. The use of CMOS proves these circuits can be mass-produced with current manufacturing techniques. See "Engineers set new world record in generation of high-frequency submillimeter waves", *Space Daily*, 17 April 2007 – http://www.spacedaily.com/reports/Engineers_Set_New_World_Record_In_Generation_Of_High_Frequency_Submillimeter_Waves_999.html.

[16] "500 Megabits/second with white LED light", Siemens press release, 16 January 2010 - http://w1.siemens.com/innovation/en/news_events/ct_pressreleases/e_research_news/2010/e_22_resnews_1002_1.htm. Researchers working with LEDs claim there is no longer any reason to use "radio" for in-room wireless networking.

The spectrum between 90 and 3000 GHz is many times larger than what we presently use for communication. However, because of high equipment costs and limited range, this band is not a complete substitute for lower bands. Nevertheless, there is strong evidence that the "high frontier" will open to the public in the next few years and it will, to some extent, complement the services supplied by lower frequencies and make new applications possible. Assessing the impact of this new region – economically and in terms of alterred demand for the lower bands – should be part of the RSPP. Indeed, "the whole of the usable spectrum needs to be reconsidered, but some parts more particularly owing to their advantages in terms of network costs."[17]

ANSWERING THE CONSULTATION DOCUMENT'S QUESTIONS

1) …has a sufficient amount of spectrum been allocated for the rollout of broadband services under technology and services neutral conditions in order to achieve EU's targets in terms of coverage and speed? Regarding already allocated spectrum, should a minimum amount of spectrum be actually assigned by a specific date?

5) How can the EU ensure that broadband services effectively contribute to bridging the digital divide, for example by reaching previously underserved areas and segments of the population? How do wired, terrestrial wireless and satellite systems best contribute to this aim?

The European Commission set a goal of achieving 100% high-speed internet coverage for all citizens by 2010 as part of the European Economic Recovery Plan. However, 70% of rural residents still lack broadband access. So clearly the coverage target has not been met.

This could be due to an overemphasis on DSL as the preferred medium for delivering broadband in rural areas. DSL may be a good solution in densely populated urban areas, but it is not the best tool for combating the digital divide in rural areas (particularly not in Cyprus, Bulgaria, Romania, Slovakia, Poland, etc.).[18]

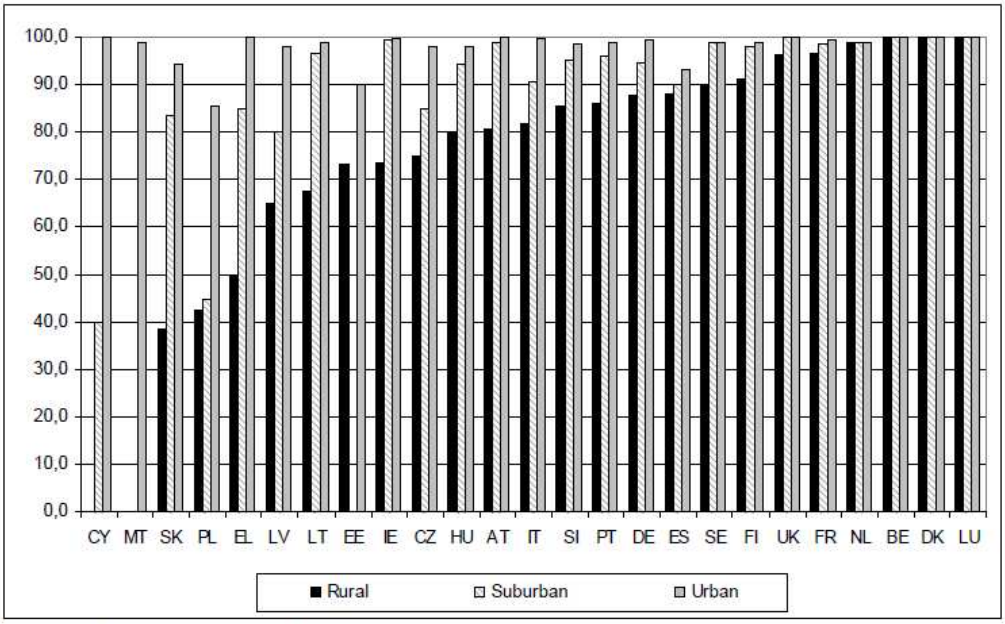
The Commission Staff Working Document *Better access for rural areas to modern ICT*[19] focuses on DSL to the point of misrepresenting data in order to support that one option. The following chart, for example, appears on page 41 of the Document. Note the title:

[17] *A Common European Spectrum Policy – Barriers and Prospects* (IP/A/ITRE/ST/2007-04), by Erik Bohlin, Colin Blackman, Simon Forge and Andrea Renda, for the European Parliament's Committee on Industry, Research and Energy (2007), page vi - http://www.europarl.europa.eu/meetdocs/2004_2009/documents/dv/itre_st_2007_spectrum_poli/ITRE_ST_2007_SPECTRUM_POLICY.pdf

[18] These countries lag in DSL deployment generally and have few installations in rural areas, according to *Broadband Coverage in Europe - Final Report, 2009 Survey*, IDATE (2009) - http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/broadband_coverage_in_europe.pdf

[19] http://ec.europa.eu/agriculture/rurdev/employment/ict/sec2009_254_en.pdf

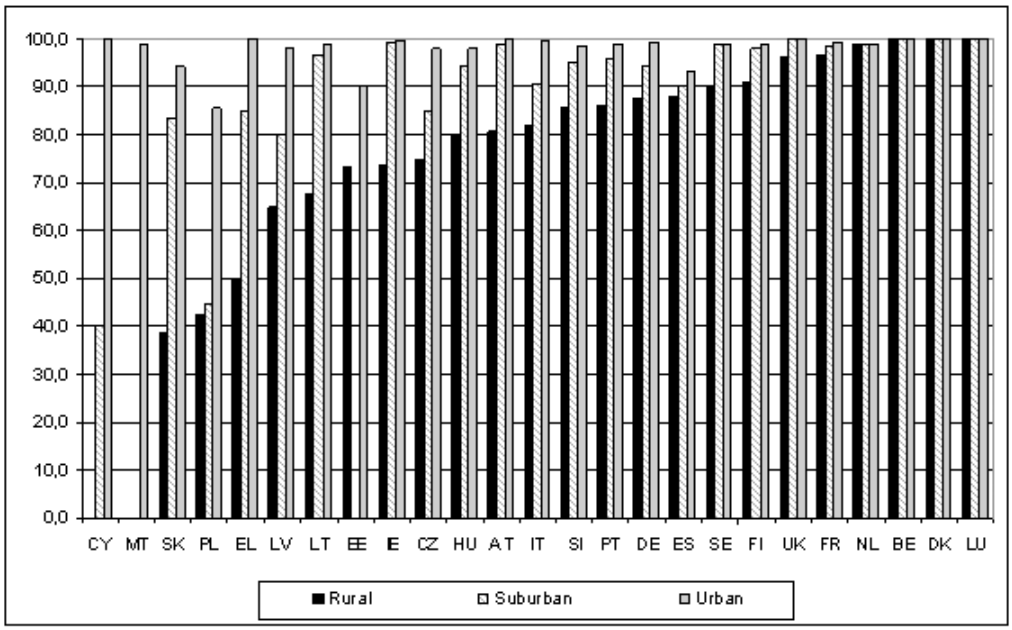
Figure 2. DSL coverage in different areas in the EU27, Dec 2007, % of total territory with DSL coverage



Note: No data for rural areas in Malta and Cyprus
Source: Rural development statistical report 2008, European Commission

The same chart appears as a separate file on the website of DG Agriculture and Rural Development, on the page where the Staff Working Document is found. Note the title here:

% of total territory covered by fixed broadband, Dec 2007



Note: No data for rural areas in Malta and Cyprus

Source: Rural development statistical report 2008, European Commission

Since the Staff Working Document identified IDATE as the source of the data, we checked IDATE's website and found "Development of broadband access in Europe – Methodological

report, 2008 Survey, Data as of 31 December 2007".[20] There IDATE explains that "broadband" in its survey was not limited to DSL: "All of the main broadband platforms have been taken into account: primarily DSL and cable modem or FTTx, in addition to other platforms such as WLL, WLAN, Satellite and PLC [Powerline Communication]…"

Perhaps it was just a misunderstanding, but the Staff Working Document denies credit to wireless broadband (and other forms of wired and cable networks) for serving rural areas, and instead attributes their achievements to DSL.

Furthermore, when the Document speaks of the percentage of "DSL coverage of rural areas" it really means the percentage of rural telephone exchanges equipped with DSL. That does not mean all telephone subscribers connected to that exchange are actually able to get DSL service. Rural telephone exchanges support a much larger geographic area than urban exchanges so a higher percentage of rural subscribers live or work beyond the "reach" of DSL than their urban counterparts. Beyond about 5 km from the exchange, DSL data speeds fall off sharply – if the customer can be served at all.[21]

A more important issue is sustainability. In 2002 the chairman of British Telecom, Sir Christopher Bland, told the UK's Parliamentary Select Committee for Culture, Media and Sport that "it simply is not economically viable for BT to roll out ADSL to parts of Britain that are sparsely populated."[22] DSL's apparent ubiquity in the UK today is due to about £1 billion in state aid, public-private partnerships and induced/aggregated demand from public services.[23] This huge subsidy had the effect of tightening BT's grip on the rural market at a time when telecommunications were supposed to be evolving toward greater competition. In general, support for DSL in any European country means support for the incumbent fixed telephone network operator.

Proliferation of DSL beyond the "economically viable" rural exchanges is a market distortion which discourages competition and investment in other channels. As the *Guardian* noted, "local ISPs are vulnerable to ADSL appearing at the local BT exchange, [making] wireless broadband a risky business."[24]

> "Many of the community broadband schemes that have sprung up around Britain could be scuppered by BT's decision to set thousands more ADSL trigger levels... [S]ome in the industry fear that community broadband activists may now find it much harder to get funding from a Regional Development Agency (RDA) or similar body

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[20] http://ec.europa.eu/information_society/eeurope/i2010/docs/future_internet/method_2008_survey_idate.pdf

[21] DSL is completely blocked by equipment which enables the splitting and sharing of telephone lines. "Around 25% of all lines may not be suitable for broadband transmission if different technical reasons are aggregated. Importantly, the overriding majority of such lines are in rural areas." *Study on Availability of Access to Computer Networks in Rural Areas: Final Report,* Directorate-General for Agriculture and Rural Development (November 2007), page 62 – http://ec.europa.eu/agriculture/analysis/external/networks/fulltext_en.pdf

[22] "Rural areas face 20-year wait for broadband", by Graeme Wearden, ZDNet UK, 5 February 2002 – http://news.zdnet.co.uk/communications/0,39020336,2103764,00.htm

[23] "Broadband Procurement To Improve Efficiency and Effectiveness of Public Service Delivery", by Mike Gunston, UK Office of Government Commerce, presented at an OECD Broadband Workshop and WPIE Meeting, Paris, France (2-4 December 2002) – http://www.positivelybroadband.org/library/downloads/Index_8e_Public%20Sector%20Broadband%20Procurement%20Study_UK.pdf

[24] "Countryside enjoys net gains", by S. A. Mathieson, *The Guardian*, 26 August 2004 - http://www.guardian.co.uk/technology/2004/aug/26/newmedia.ruralaffairs

> to finance a solution in one of Britain's broadband backlogs if an ADSL target has now been set.
>
> "'It's an issue of perception. Once people hear that BT might roll out broadband in their area, they think everything is OK,' an informed source told ZDNet UK. 'An area that was previously seen as being unviable for ADSL broadband by an RDA, and therefore suitable for funding to receive a community broadband project, may have that status reversed if it now has a BT trigger level assigned to its local exchange...'"[25]

In 2004 the OECD cautioned against an overheated rush to ubiquitous broadband which undermines the longer process of developing sustainable competition. OECD's expert had marvelled at the large number of small, new and innovative WISPs targeting sparsely settled areas in the UK with low-cost, high-speed wireless services. What would he say now that so many of these WISPs were destroyed by BT's smothering embrace of broadband?:

> "The main message for OECD policy makers is to give the market time to develop broadband access... A delay in the availability of service for rural users should not be taken to be an automatic sign of market failure.... The main objective for governments... should be to facilitate competitive entry in rural areas. This approach is likely to be far more conducive to the roll out of broadband availability than funding in the form of subsidies..."[26]

History seems to be repeating itself with the Commission's rush to develop ubiquitous broadband beyond economically viable areas using various forms of state aid. But there is no reason to put all eggs in one basket. *Competition between different delivery modes* has been identified as one of the key factors stimulating broadband take-up.[27] The poor take-up rate in rural areas served by DSL – noted in the Staff Working Document but not acknowledged as the greater problem – could be due to a persisting lack of choice among technologies for potential broadband subscribers.

We support the goal of broadband for all, and do not oppose the use of state aid for that purpose – *so long the aid does not undermine more sustainable and affordable options.*

Wireless networks are almost universally recognised as the most cost-effective means for bringing broadband access to low-density populations. The diagram at the top of the next page (developed by Communications Research Centre Canada in 2006) shows the cost per user for various broadband access technologies as a function of population density.[28] In the diagram, population density increases from left to right while the cost of building and operating a network rises from bottom to top. Various technologies are represented by colored lines curved to show how population density affects cost. The cost curves may not

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[25] "BT trigger levels scupper community broadband" by Graeme Wearden, ZDNet, 25 November 2003 – http://news.zdnet.co.uk/communications/broadband/0,39020342, 39118106,00.htm

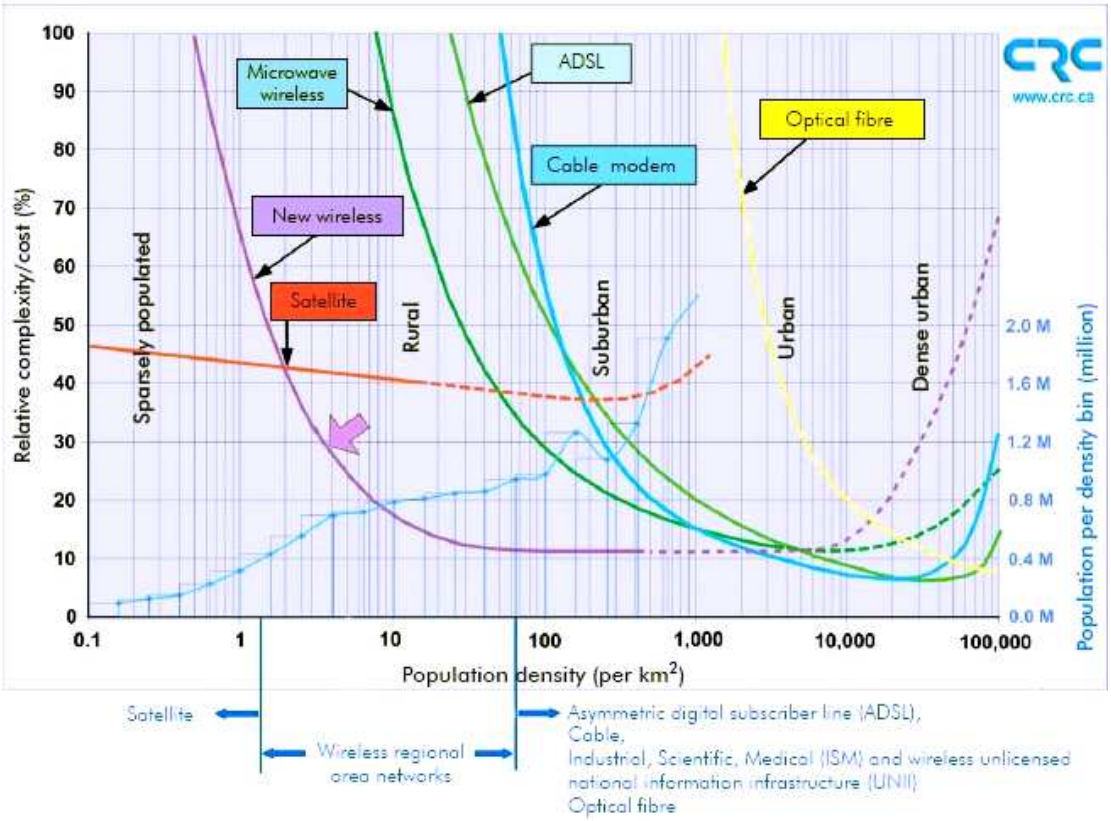
[26] *The Development of Broadband Access in Rural and Remote Areas*, Organisation for Economic Co-operation and Development (OECD), DSTI/ICCP/TISP(2003)7/Final (10 May 2004), page 9 – http://www.oecd.org/document/43/0,2340,en_21571361_34590630_31718315_1_1_1_1,00.html.

[27] "For the enlarged EU, there is a clear, 41%, correlation between the level of broadband take-up and competition between access modes," according to "Broadband and i2010: The importance of dynamic competition to market growth" by Richard Cadman and Chris Dineen, Strategy and Policy Consultants Network Ltd. (2005), page 1 – http://www.spcnetwork.co.uk/uploads/EU_Broadband_Markets.pdf

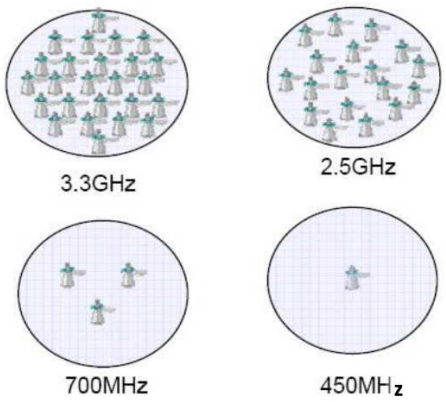
[28] Diagram from "Bringing broadband access to rural and remote areas: the Canadian experience" by Gérald Chouinard, *ITU News*, issue 3 (2006) - http://www.itu.int/itunews/manager/display.asp?lang=en&year=2006&issue=03&ipage=canadian&ext=html

correspond exactly to European reality today, but a 700 MHz wireless network (called "New wireless" in the diagram) is shown to be 75% cheaper per user than DSL when population density is 60 per km^2 – that is typical of Scandinavia, Ireland, the Baltic countries, Poland and Spain. At the same population density, a wireless network using 2.4 GHz to connect end users with a 5 GHz "backbone" (called "Microwave wireless" in the diagram) is 50% cheaper per user than DSL. At even lower population densities, the economic advantage of wireless is even greater, especially for the 700 MHz system, and wireless retains its cost advantage over DSL until "urban" densities are reached (5000+ people per km^2):

Suitability of Broadband Access Technologies as a Function of Population Density (from *ITU News*, 2006/3)



This shows the benefits of releasing frequencies in the UHF band for the deployment of wireless broadband access networks outside urban areas. And because of the superior range and foliage penetration of signals at 450 MHz, "white space" frequencies at the low end of the UHF television band offer even greater advantages and cost saving potential for rural broadband.[29]



The current inadequacy of broadband access in remote and sparsely-populated regions strongly suggests that commercial network operators find the anticipated return on investment in such locales insufficiently attractive. We believe that appropriate policy responses to this situation at the European level should begin with changing the infrastructure cost equation by modifying regulations that keep the

[29] Diagram from "Digital Dividend: A technology disruption in mobile broadband" by Manas Ganguly (December 2009) – http://www.slideshare.net/Manas.Ganguly/digital-dividend-2451233

cost of building out broadband networks higher than it needs to be.

As noted above, wireless links are the least expensive option for connecting remote communities to the global Internet and to national services. License exempt radio equipment based on open standards normally costs less – often very much less – than similar equipment with proprietary designs for licensed channels. In addition, the cost of spectrum use rights in the license-free bands is zero. Therefore, to minimise the cost of bringing broadband service to remote settlements, the Commission should encourage the use of license exempt equipment over longer paths – and in more diverse contexts – than current regulations allow. This can be achieved by recommending that national regulatory authorities (NRAs)

- increase the radiated power limits for equipment operating in sparsely populated areas under general authorisations;
- allow more freedom in the choice of antenna configurations for license exempt equipment in areas where the risk of interference is low;
- allow additional types of equipment to operate under general authorisation when deployed in rural areas (geo-location databases created to support cognitive use of TV "white spaces" could also be used for this purpose); and
- allow the use of TV "white spaces" by radio access networks under rules which do not raise their costs unnecessarily or unduly restrict their geographic operation. (We are concerned that the recommendations produced by CEPT concerning "white space" use may be overly restrictive.)

Even with such cost saving measures, some rural areas may not be able to attract an adequate level of commercial investment. However, there are other investment models which may more appropriate. Large numbers of not-for-profit wireless networks have appeared in recent years, operated and financed voluntarily by communities of end-users for their own benefit or for more altruistic reasons. (The most recent list we have seen – not updated since 2005, unfortunately – shows 174 community wireless networks in the EU member states.) Most are co-operatives with no formal relationship with any public authority or subsidy from any public budget. Yet they are wellsprings of practical know-how and social commitment – authentic, positive models of self-help. Some of them are OSA members:

- **Athens Wireless Metropolitan Network** (http://www.awmn.net/) - founded in 2002, and now with 2,889 Wi-Fi links connecting 12,500 active nodes, AWMN is the largest of the 21 community networks in Greece.
- **Funkfeuer.at** (http://www.funkfeuer.at/) – Founded in 2003, Funkfeuer.at is a free experimental network with 600 mesh links covering about one-third of Vienna and parts of Graz.
- **Freifunk.net** (http://freifunk.net/) - Founded in 2003, Freifunk now connects about 6000 people in Berlin, Leipzig and Weimar in the Internet.
- **Guifi.net** (http://guifi.net/) – founded in 2004 and now with 9,160 nodes spread throughout Catalonia, Guifi.net is one of the largest noncommercial Internet access networks in Europe. Users pay for the equipment needed to join the net but once connected, service is free. Guifi.net won Spain's National Telecommunications Award in 2007.

We were disappointed but not surprised that the Staff Working Document omitted all reference to the contribution non-profit, user-owned wireless networks make to closing the Digital Divide. We believe strongly that the Commission should encourage these vital grassroots initiatives

- by sponsoring an EU-wide survey to identify and profile these networks, and tally the number of people they serve;

- by sponsoring an EU-wide conference on community wireless networks, how they are reducing Europe's Digital Divide, and what can be done to expand their contribution;
- by creating a small programme to facilitate the transfer of knowledge, software and expertise from existing community networks to rural areas which currently lack such networks but which desire help in forming one. (The "e-rider" model would be most appropriate, we think, in which resource persons visit several client communities on a recurring basis.[30])
- and by encouraging the further use of structural funds to support the development of user-owned networks in rural areas. We generally support the continuation of the ERDF guidelines published in 2003, though they could be improved by adding a section on communication co-operatives.[31]

4) While maintaining a large amount of spectrum for the continued development of high quality pluralist broadcasting, should Europe take further action to ensure the complete transition to low/medium power use of the 790-862 MHz band and the provision of wireless broadband in order to ensure the widest possible coverage for EU citizens and business? Should coverage obligations be attached to these spectrum usage rights?

We have already indicated our support for the use of the UHF band to provide wireless broadband access to the Internet, not just above 790 MHz, but below 790 MHz as well. Like Ms. Kroes, we do not believe that incumbency should block debate about the best use of the entire UHF band or preclude its re-allocation. We think the Parliament and RSPG should initiate the kind of debate which has begun in the US on how to rebalance broadcasting and broadband.

13) How can EU policy priorities best be defended throughout the negotiations at WRCs to guarantee effective solutions, and how is the EU position to be expressed to EU negotiating partners?

Earlier we expressed our support for the use of "general" and "individual authorization" in place of "unlicensed" and "licensed" as recommended by the ECC in Report 132. To avoid conflict with the International Telecommunication Union's continuing use of older terminology, it would be desirable for Europe to work for updating of Article 18 of the International Radio Regulations, which still stipulates that "*no transmitting station may be established or operated by a private person or by any enterprise without a licence...*" Changing the phrase "a licence" to "an authorization" is one obvious solution, but modifying the rest of the sentence -- and the rest of Article 18 – must be carefully considered since so many national laws depend on the exact formulation of this part of the treaty. Nevertheless, **it is very much in Europe's interest to have its policy on authorisation become the global norm for regulators.**

While speaking of definitions, we must raise another potentially controversial issue. In 2000 the World Radiocommunication Conference (WRC) changed the definition of "radio" used by the ITU, raising the upper frequency limit from 400 GHz to 1000 GHz.[32] The next WRC in

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[30] See http://www.eriders.net/

[31] "Guidelines on Criteria and Modalities of Implementation of Structural Funds in Support of Electronic Communications," Commission Staff Working Paper SEC(2003) 895 (Brussels, 28 July 2003) - http://ec.europa.eu/regional_policy/sources/docoffic/working/doc/telecom_en.pdf

[32] "275+ GHz", by Hans Blondeel Timmerman, International Amateur Radio Union -- http://www.iaru-r1.org/index.php?option=com_content&view=article&id=205&Itemid=159

2003 raised it again, to 3000 GHz.[33] And in November 2007, the latest WRC decided that the ITU should start exploring the need for procedures to regulate "free-space" optical frequencies above 3000 GHz.[34]

Frequent raising of the upper limit in "radio's" definition is a sign of rapid progress in developing means for exploiting spectrum regions which had previously been inaccessible or unusable. As we noted earlier in this text, that holds the promise of meeting some of our burgeoning demand for bandwidth which is proving increasingly hard to satisfy in lower bands. But we need to start asking: *is there no limit to the jurisdictional claims of national governments and the ITU with regard to electromagnetism?* When the ITU decides that the frequencies of visible light are subject to regulation, will we need government authorisation to light a candle? Will lasers be brought within the scope of the R&TTE directive?

These are extreme possibilities, admittedly, but we are distressed that so little public debate has accompanied these moves to expand the legal definition of radio - and thus governmental authority - far beyond what most people consider as "radio".

While we support the use of "individual authorisation" in place of the word "license", we must note the assumption that persists in radio regulation that *all private uses of radio must be government authorised*. We have no tradition of requiring government authorisation for people who wish to generate, transmit or detect light - nor is that desirable. And yet we are already on a "slippery slope" toward that end -- unless Europe takes a principled stand against that in the ITU. We would even encourage a rollback of ITU and national regulatory authority to 1000 or 3000 GHz.

Procedures for regulating optical frequencies above 3000 GHz in free space will be considered and possibly recommended at WRC-12 under Agenda Item 1.6. We urge Europe's representatives at that event -- and those involved in preparatory work conducted by the ITU Study Groups in the years leading up to that event -- to *leave light unregulated.*

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[33] Article 1 of the International Radio Regulations' 2004 revision defined "radio waves" as "Electromagnetic waves of frequencies arbitrarily lower than 3 000 GHz, propagated in space without artificial guide." -- http://life.itu.int/radioclub/rr/art01.htm

[34] In Resolution 118, the ITU Plenipotentiary Conference decided in 2002 – to extend the ITU's administrative mandate into the realm of visible light by allowing future WRCs to include in their agendas items dealing with the regulation of frequencies above 3000 GHz. WRC-07's resolution on the regulation of optical frequencies is an early and direct result of that decision. See "Resolution COM6/9 (WRC-07): Consideration of procedures for free-space optical links," in *World Radiocommunication Conference Provisional Final Acts* (Geneva, 22 October – 16 November 2007), pages 460-1.

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